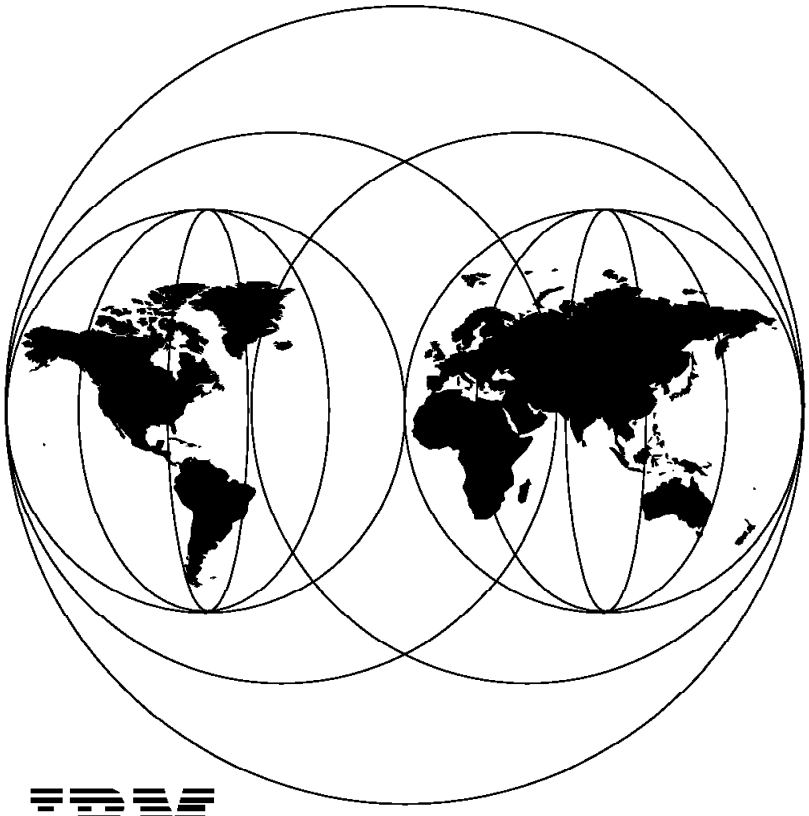
SG24-4409-02

Guide to Sharing and Partitioning IBM Tape Library Dataservers

November 1996



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International Technical Support Organization

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SG24-4409-02

Guide to Sharing and Partitioning IBM Tape Library Dataservers

November 1996

Take Note!

Before using this information and the product it supports, be sure to read the general information in Appendix C, “Special Notices” on page 235.

Third Edition (November 1996)

This edition, SG24-4409-02, is a major revision of GG24-4409-01, which is now obsolete. Major changes are for the IBM Magstar Virtual Tape Server and IBM 3494 capacity enhancements that are announced on September 1996. Significant changes or additions to the text, tables, and illustrations are indicated by a vertical line to the left of the change.

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Preface

This document is unique in its detailed coverage of sharing and partitioning IBM 3494 and 3495 tape libraries in multiple host system environments. It provides the following:

- Introduction to sharing and partitioning an IBM Automated Tape Library
- Overview of IBM Automated Tape Library including the IBM Magstar Virtual Tape Server
- Description of software environments that support IBM IBM Automated Tape Library
- Discussion of the basic concepts of *sharing* and *partitioning*
- Implementation steps required to share and partition IBM Automated Tape Library on the MVS/ESA, VM/ESA, VSE/ESA, AIX/6000, OS/400, and TPF platforms.

This document is written for storage system specialists. Some knowledge of tape library systems is assumed.

How This Redbook Is Organized

This redbook contains 256 pages. It is organized as follows:

- Chapter 1, “Introduction”

  This chapter gives an overview of implementing multisystem access to IBM 3494 and 3495 Automated Tape Library Dataservers.

- Chapter 2, “Overview”

  This chapter describes the basic concepts and features of the IBM 3494 and 3495 tape libraries. It presents configuration guidelines for sharing and partitioning the tape libraries, and discusses the capabilities and connectivity of each hardware model. The IBM 3590 High Performance Tape subsystem is also introduced.

- Chapter 3, “Software Environments”

  This chapter describes the various software that supports IBM 3494 and 3495 tape libraries. The MVS/ESA, VM/ESA, VSE/ESA, AIX/6000, and OS/400 The MVS/ESA, VM/ESA, VSE/ESA, AIX/6000, OS/400, and TPF environments are discussed.

- Chapter 4, “Multisystem Access”

  This chapter describes the basic concepts of sharing and partitioning. We explain the terms *sharing* and *partitioning* along with the requirements for using a single tape library or multiple tape libraries in either shared or partitioned mode.

- Chapter 5, “Implementation in a DFSMS/MVS Environment”

  This chapter describes partitioning and sharing a tape library for an MVS/ESA system that controls the tape library using DFSMS/MVS. We discuss the basic implementation steps and the steps to be performed to share or partition the tape library between DFSMS/MVS and other SMSplexes or other platforms.

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- Chapter 6, “Implementation in a Basic Tape Library Support Environment”

  This chapter describes the basic implementation steps of Basic Tape Library Support on MVS/ESA systems and examines the general considerations for sharing and partitioning a tape library with BTLS.

- Chapter 7, “Implementation in a DFSMS/VM Environment”

  This chapter describes the basic implementation of DFSMS/VM RMS and explains how to partition and share the tape library between DFSMS/VM RMS and other systems with respect to tape drives and volumes. In addition we cover the use of DFSMS/VM RMS with VGS.

- Chapter 8, “Implementation in a VSE/ESA Environment”

  This chapter describes the VSE/ESA Library Control Application that supports IBM 3494.

- Chapter 9, “Implementation in an AIX/6000 Environment”

  This chapter describes the basic implementation of sharing and partitioning the tape library in AIX/6000 environment.

- Chapter 10, “Implementation in Other Environments”

  This chapter describes the basic implementation of sharing and partitioning the tape library in other environments, such as OS/400 with BRMS/400, and TPF environments.

- Appendix A, “Library Manager Volume Categories”

  This appendix contains a list of all Library Manager volume categories. The list indicates on which platforms they are used and their meaning.

- Appendix B, “The IBM Magstar Virtual Tape Server”

  This chapter describes the basic concepts of the IBM Magstar Virtual Tape Server (also called tape volume stacking) and provides configuration guidelines.

The Team That Wrote This Redbook

This redbook was produced by a team of specialists from around the world working at the International Technical Support Organization San Jose Center.

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This publication is the result of a residency conducted at the International Technical Support Organization, San Jose Center.

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Chapter 1. Introduction

In this book, we discuss the implementation of multisystem access to IBM 3494 and 3495 tape libraries. Because there is no manual intervention such as by a human operator, it is much more important to explicitly define the proper environments and drive assignment to a specific host system.

In a manually operated environment, the tape operator can easily find out which volumes belong to which system and which volumes can be mounted on which tape drives by means of, for example, different volume locations, different volume label colors, other operational procedures, or experience. In an automated tape library environment, the Library Manager who controls both the operation of an IBM Automated Tape Library and the host software needs to make these decisions.

Therefore, in this book we focus only on IBM Automated Tape Library. You can also use the recommendations and guidelines in this book for a manual tape library such as the IBM 3495 M10 Manual Tape Library Dataserver as far as sharing within a single platform is concerned. However, we do not intend to discuss the sharing and partitioning of such a manual tape library in detail in this book.

To operate an IBM Automated Tape Library, you need to have specific hardware and Licensed Internal Code (LIC) as well as the supporting software installed. Figure 1 on page 2 gives an overview of the required hardware components and the attachment possibilities of the IBM Automated Tape Library. We show an AS/400 system, a RISC/6000, a POWERparallel SP2 system, an ES/9000 system, a S/390 Parallel Server system, and an ESA-capable processor system sharing a 3494. The 3495 is shared between a RISC/6000, a POWERparallel SP2 system, an ES/9000 system, a S/390 Parallel Server system, and an ESA-capable processor system.

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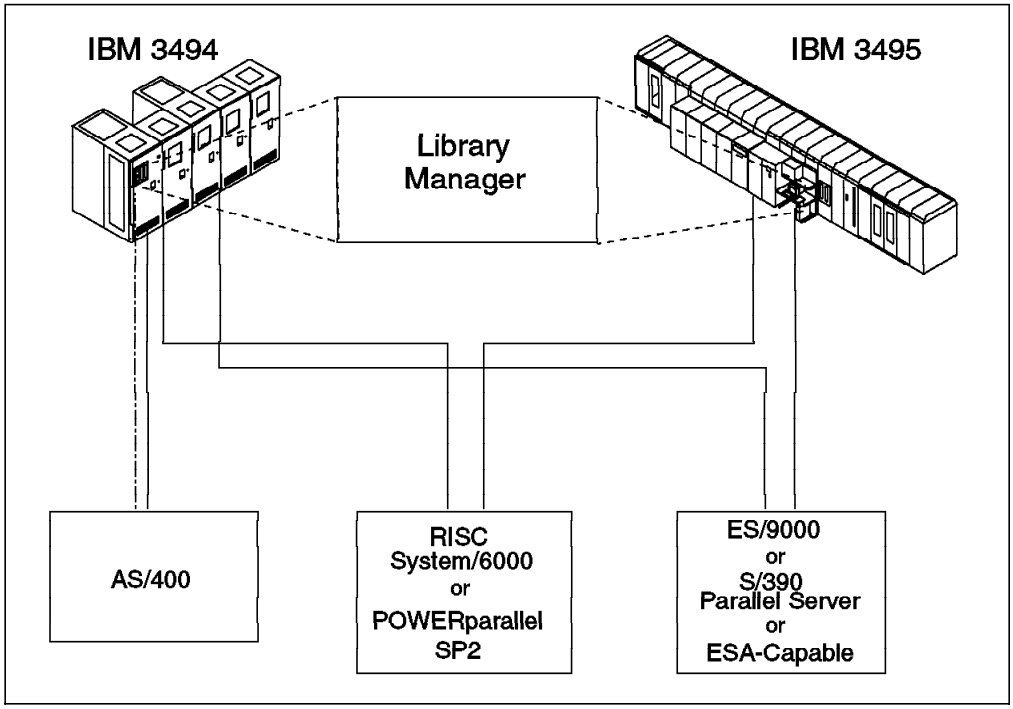

Figure 1. Automated Tape Libraries Hardware Components

The Library Manager is the central component that manages all movements inside an IBM Automated Tape Library and communicates with all attached hosts. In the RISC/6000 with ESCON or parallel channel attachment, POWERparallel SP2, ES/9000, System/390 Parallel Server, and ESA-capable processor environment, communication is done through the channel attachment of the tape drives residing inside the IBM Automated Tape Library. In the AS/400, RISC/6000 with Small Computer System Interface (SCSI) attachment, and native VSE/ESA system environment, the Library Manager is separately attached to the host system through an RS-232 or local area network (LAN) connection.

For more information on the required hardware components, please refer to Chapter 2, “Overview” on page 5. In addition to the hardware components, several layers of software support the automated tape operation of an IBM Automated Tape Library. Figure 2 shows the different software layers and some examples for each layer.

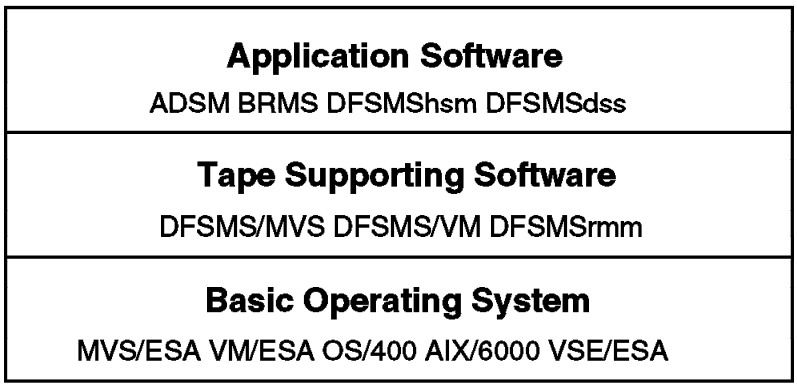

Figure 2. Software Structure

For more information on the different software environments please refer to Chapter 3, “Software Environments” on page 37.

Sharing in a tape environment is different from sharing in a DASD environment. You can simultaneously access a DASD volume from different users at a single point in time. Different users may access the same data set, and the DASD volume can be online to several systems.

Figure 3 outlines the differences between sharing in a DASD and in a tape environment.

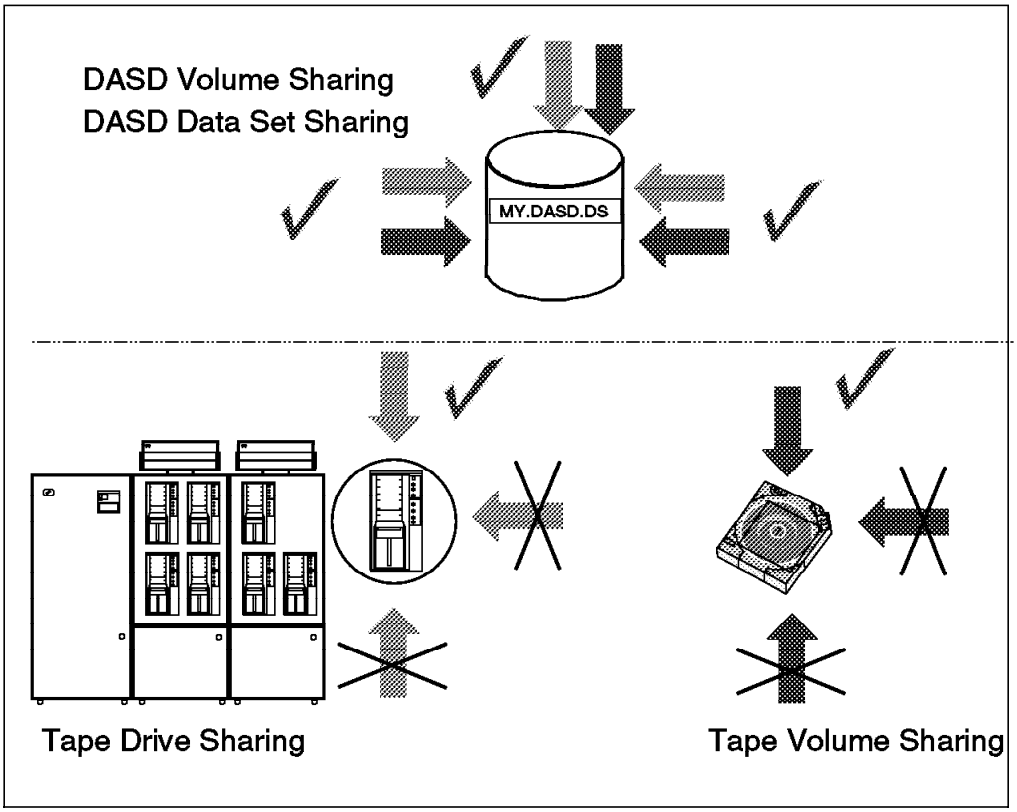

Figure 3. Sharing DASD and Tape

In a tape environment, a tape drive can be attached to only one system and one user at a time. Thus, only one user has access to a tape data set at a single point in time. However, multiple users can access a tape volume or tape drive one after another. Therefore, we cover sharing of data and tape volumes in detail in this book. We talk about dynamic reassignment of tape drives where applicable.

An IBM Automated Tape Library can be shared by different systems in two ways: by logically dividing it into different partitions (*partitioning*) or by allowing all attached systems to sequentially access the tape volumes in the library (*sharing*). We explain the concepts of both alternatives in Chapter 4, “Multisystem Access” on page 63.

Attaching multiple hosts of different platforms to an IBM Automated Tape Library requires special consideration because the different platforms might handle differently such aspects of tape processing as:

- Tape management
- Allocation control
- Host control data sets
- Code in which data is written to tape
- Data format
- Internal tape volume label
- Security.

We discuss special considerations for multihost access to an IBM Automated Tape Library for every platform in Chapter 5, “Implementation in a DFSMS/MVS Environment” on page 87 to Chapter 10, “Implementation in Other Environments” on page 171 for the following environments:

- MVS/ESA (DFSMS/MVS and Basic Tape Library Support – BTLS)
- VM/ESA (DFSMS/VM and VSE Guest support)
- VSE/ESA
- AIX/6000
- OS/400
- TPF.

Table 1 summarizes the multihost access options for the environments covered in this book.

Table 1. Sharing and Partitioning Summary

Platform	DFSMS/MVS	BTLS	DFSMS/VM	VSE/VGS	VSE/LCDD	AIX/6000	OS/400	TPF
DFSMS/MVS	P S D	-	-	-	-	-	-	-
BTLS	P C D	P S D	-	-	-	-	-	-
DFSMS/VM	P C	P C	P S D	-	-	-	-	-
VSE/VGS	P	P C	P C D	P S D	-	-	-	-
VSE/LCDD	P	P C	P C	P	P S D	-	-	-
AIX/6000	P C	P C	P C	P C	P C	P S D	-	-
OS/400	P	P C	P C	P	P C	P C D	P S	-
TPF	P C	P C	P C	P C	P C	P C	P C	P S

Notes:

P indicates partitioning of the IBM Automated Tape Library.

S indicates sharing of all tape volumes.

D indicates dynamic sharing of tape drives.

C indicates cross-platform sharing of private volumes.

Chapter 2. Overview

In this chapter, we describe the basic concepts of the IBM 3494 and 3495 Tape Library Dataservers and explain and compare the unique features of each. At the end of the chapter we present configuration guidelines for sharing and partitioning IBM Automated Tape Library.

2.1 Basic Concepts

IBM offers two IBM Automated Tape Library: the IBM 3494 and 3495. Although each product addresses the needs of a different market, both share common design elements. The IBM 3494 addresses the needs of small to large customers, and the IBM 3495 addresses the needs of large to very large customers.

Figure 4 shows the IBM 3494 and 3495 Tape Library Dataservers (relative sizes are not to scale).

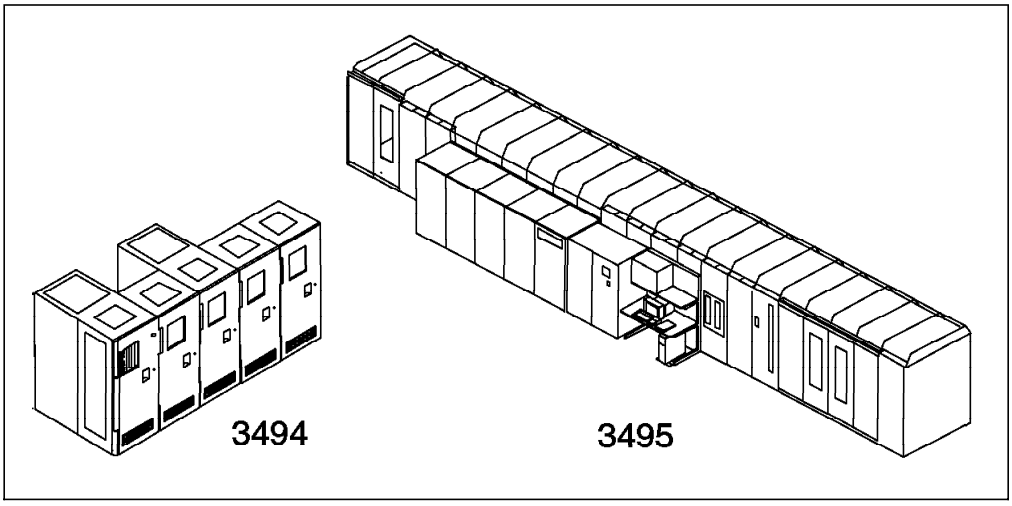

Figure 4. IBM 3494 and 3495 Tape Library Dataservers

The IBM Automated Tape Library are self-contained, fully enclosed products that can be installed on a solid or raised floor. Both IBM Automated Tape Library have:

- A cartridge accessor for mounting and demounting cartridges
- Cartridge storage cells for storing cartridges
- IBM 3490 (in the IBM 3495 only), along with IBM 3490E or IBM 3590 tape subsystems, or both.
- A Library Manager for communicating with the host systems and controlling all activities within the IBM Automated Tape Library.

Figure 5 on page 6 shows the basic building blocks of an IBM Automated Tape Library.

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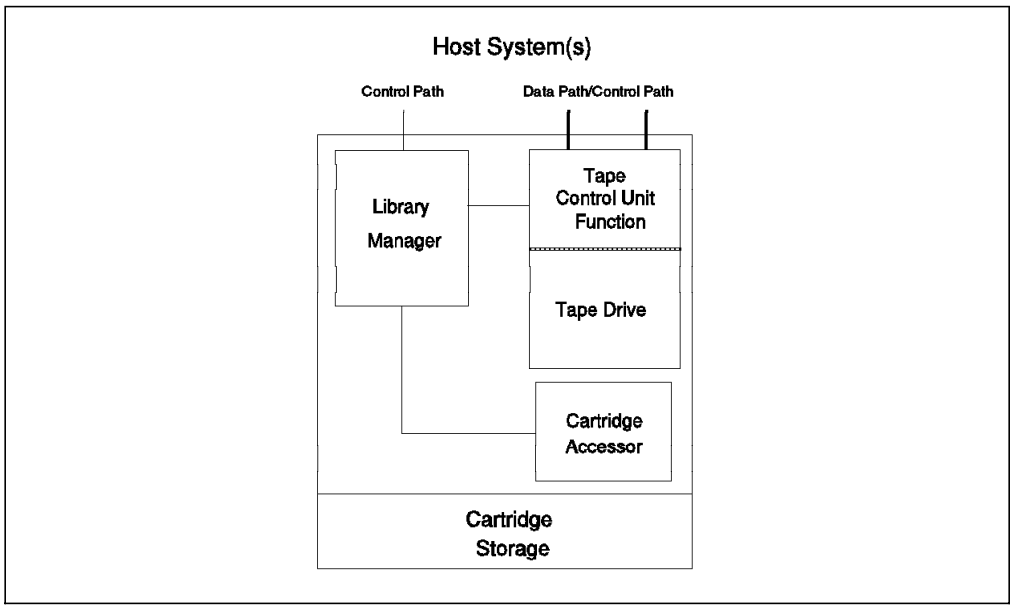

Figure 5. Basic Building Blocks of an IBM Automated Tape Library Dataserver

Standard Cartridge System Tapes (CSTs), two-tone Enhanced Capacity Cartridge System Tapes (ECCSTs) and IBM 3590 Cartridges can be intermixed in the IBM Automated Tape Library.

If a cartridge accessor failure occurs, the IBM Automated Tape Library can operate in manual mode. This mode allows continuous, nonautomated operation, with the operator performing the actions that are typically performed by mechanical devices.

2.1.1 New IBM 3590 High Performance Tape Subsystem

In this section we briefly describe the new IBM 3590 High Performance Tape Subsystem, which uses the new IBM 3590 tape drive (also known as the **Magstar** tape drive).

Physically the new tape cartridge is similar enough to the IBM 3480 and 3490 cartridge design in terms of external size and shape that it is compatible with them in terms of robotic handling. However, the IBM 3590 High Performance Tape Cartridge has a capacity of 10 GB (with uncompacted data) or 30 GB assuming a data compaction rate of 3 to 1. Applications such as ADSM, BRMS/400, and DFSMShsm can fully use the capacity of the IBM 3590 High Performance Tape Cartridge. Other applications, such as a single dump of a disk volume, will use only a fraction of the tape cartridge capacity. The IBM 3590 announcement includes a Statement of Direction (SOD) that IBM will provide “volume stacking” capacity-enabling technology on the ESCON-attached library products; this will increase the ability to use the full capacity of the IBM 3590 tape cartridge.

Fulfilling this statement of direction, IBM now announces the IBM Magstar Virtual Tape Server (VTS) for IBM 3494 and 3495 Tape Libraries. For detailed information about Virtual Tape Server, please see Appendix B, “The IBM Magstar Virtual Tape Server” on page 185 or Redbook, *The IBM Magstar Virtual Tape Server and Enhancements to Magstar: New Era in Tape*.

The tape itself is 0.5 inch (1.27 cm) wide and 300 m (984 ft) long, which is similar to the 320-m (1050-ft) IBM 3490E ECCST. Thus, the time it takes to access the data, do high-speed searches, and rewind will be little changed from that of the current ECCST, despite the considerable increase in capacity.

A new metal-particle medium is used in the IBM 3590 High Performance Tape Cartridge. The new medium permits a much higher data recording density, and hence the ability to write 128 tracks. The recording style is linear serpentine, and prerecorded servo tracks are used to position the 16 read/write heads accurately.

The IBM 3590 tape drive has a data rate of 9 MB/s; this is three times faster than the IBM 3480, 3490 or 3490E tape drive. It has built-in and improved compression, as well as built in control function. Subsequent sections explain which IBM 3590 models can be used within the IBM 3494 and 3495 tape libraries, and also which hosts support the IBM 3590 tape subsystem.

The tape cartridge and the media used with the IBM 3590 tape drive—the IBM 3590 High Performance Tape Cartridge—are completely new; they are not compatible with any other IBM tape subsystems. You cannot read from or write to this tape using IBM 3480, 3490, or 3490E tape subsystems.

Note: The IBM 3590 tape drive can neither read from nor write to earlier IBM tape cartridge formats—that is, neither 18-track nor 36-track format.

You do not need to worry about accidentally inserting a non-3590 cartridge into an IBM 3590 tape drive, or an IBM 3590 cartridge into a non-IBM 3590 tape drive: the cartridge would not be accepted into the drive. (IBM 3590 cartridges do not fit into IBM 3480/3490/3490E drives because the IBM 3590 cartridge leader block has been modified; the IBM 3590 drive can detect a non-IBM 3590 cartridge by the absence of the new plastic inserts built into the new 3590 cartridges)

Table 2 illustrates which cartridge types can be processed on which devices. A cartridge written in 18-track mode can be read on an IBM 3490E drive but cannot be modified. The IBM 3480 tape technology is shown for completeness only; IBM 3480 tape drives are not supported in either IBM 3494 or 3495 tape library. Also, IBM 3490 (18 track) tape drives are not supported in the IBM 3494.

The data compression feature, the Improved Data Recording Capability (IDRC), is standard for both the IBM 3490E and 3490 but is optional for the IBM 3480. The IBM 3590 uses a new compression algorithm called IBMLZ1, which is not compatible with the IDRC.

Table 2. Tape Drive and Cartridge Compatibility

Cartridge Type and Recording Technology	Tape Drive			
	IBM 3590	IBM 3490E	IBM 3490 or 3480 with IDRC	IBM 3480 without IDRC
IBM 3590 Cartridge 128-track	Read/write	N/A	N/A	N/A
ECCST 36-track	N/A	Read/write	N/A	N/A
CST 36-track	N/A	Read/write	N/A	N/A
CST 18-track	N/A	Read only	Read/write	Read/write

The following is a quick overview of 3590 models:

IBM 3590-B11 SCSI-attached tape drive with Automated Cartridge Facility (ACF). Has its own integrated control unit function. The IBM 3590-B11, housed in a IBM 3590-A14 rack together with the IBM 3590-A00 control unit, can only be used outside the IBM 3494 and 3495 Tape Libraries.

IBM 3590-B1A SCSI-attached tape drive without ACF. Has its own integrated control unit function. It is specifically designed to reside in the IBM 3494, either in native mode or under the control of the IBM 3590-A00, or in the IBM 3495 only under control of the IBM 3590-A00.

IBM 3590-A00 This ESCON-attached controller can control up to four IBM 3590 tape drives. The IBM 3590-A00 counts as one control unit function even when it is controlling multiple 3590 tape drives.

IBM 3590-A14 Rack that houses an IBM 3590-A00 control unit with the attached IBM 3590-B1A tape drives (without ACFs). This counts as a complete subsystem and can be installed in the IBM 3495. When it is installed in the there, it must be configured with the maximum four IBM 3590-B1A tape drives. The IBM 3590 subsystem configured in an IBM 3590-A14 rack can be used outside the IBM 3495 tape library as a stand-alone subsystem using IBM 3590-B11 tape drives.

For further information on IBM 3590, please see the following:
IBM 3590 High Performance Tape Subsystem User's Guide,
Magstar and IBM 3590 High Performance Tape Subsystem Technical Guide, and
Magstar and IBM 3590 High Performance Tape Subsystem: Multiplatform Implementation.

2.1.2 Library Manager

The Library Manager, which consists of the LIC for library management and communicates with the host systems, controls all activities in the IBM Automated Tape Library. The Library Manager receives requests from hosts for automated operations and returns status information.

The Library Manager can communicate with the host system through four control paths: ESCON, parallel, RS-232, and LAN. The LAN control path uses a Token-Ring or Ethernet physical link and Advanced Program-to-Program Communication (APPC) or Transmission Control Protocol/Internet Protocol (TCP/IP).

The host system has no knowledge of the actual physical location of a volume in a particular IBM Automated Tape Library. The physical location is managed exclusively by the Library Manager, which stores the physical location of the volumes in an inventory database, based on its volume serial number.

The Library Manager manages the operations queue with a set of priority levels. It places operation requests in the queue in priority order. The mounting of cartridges takes precedence over most other operations.

The Library Manager communicates with the operator when required and provides an activity log as a problem determination aid for use by the IBM Service Representative.

2.1.3 Control Information and Data

The IBM Automated Tape Library can be attached to the host systems by two methods (see Figure 6).

Method 1 attaches the IBM Automated Tape Library through the tape subsystem control unit by using ESCON or parallel channels. No additional attachments are required. A separate channel or communication link to the Library Manager from each attached host is not required because existing channels to the tape subsystems are used to pass control information to the Library Manager. This method is available for both the 3494 and 3495.

Method 2 uses RS-232 or LAN attachments to pass control information directly between the Library Manager and the host systems. For the data path, ESCON, parallel, and SCSI channels are used. This method is available only for the 3494.

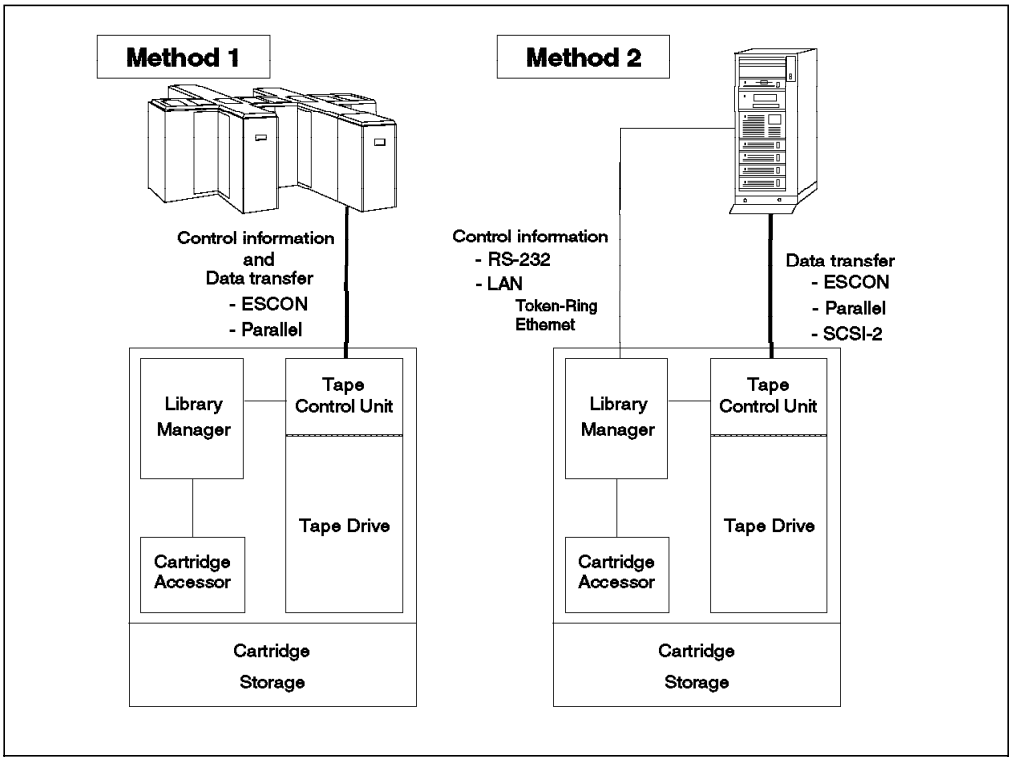

Figure 6. Host Connections

2.1.4 Tape Cartridge Labeling

Because CSTs, ECCSTs, and IBM 3590 cartridges can be intermixed in the IBM Automated Tape Library, it is important to ensure that the Library Manager can differentiate among the different types of cartridges.

Each cartridge must have an operator- and machine-readable external label to identify it during initial inventory and any time it is added to the IBM Automated Tape Library through an input facility. The Library Manager uses only the external label to identify each cartridge residing in an IBM Automated Tape Library. To avoid inconsistencies, the external label of a volume must match the internal label, and the volume serial number must be unique throughout the whole system (which includes DASD, and optical volumes).

Note: As we explain later, the IBM 3494 can also support unlabeled cartridges if necessary.

There also needs to be some mechanism to let the Library Manager know the cartridge type of all cartridges in the Library. This is achieved by adding a seventh character as a media type indicator on the external cartridge label: “1” for a CST, “E” for an ECCST, and “J” for an IBM 3590 cartridge.

If the tape library has only one type of cartridge, you can set this type as the default within the Library Manager, so that no additional seventh character is needed on any cartridges. This applies to both IBM 3494 and 3495 tape libraries.

In a IBM 3494, the barcode reader cannot distinguish between the monotone (CST), two-tone (ECCST), and IBM 3590 cartridges, so the seventh character is needed if you have mixed cartridge types. If you mix CST with ECCST, the ECCST cartridges will need the “E” media indicators. If you mix IBM 3590 cartridges with any other type, every cartridge (including CST) must have a seventh character as a media type indicator.

In a IBM 3495, the vision system can distinguish between the monotone (CST) and two-tone (ECCST) cartridges, but it cannot identify IBM 3590 cartridges, making the seventh character “J” a necessary addition to IBM 3590 cartridges.

2.2 IBM 3494

The IBM 3494 Tape Library Dataserver is a low-cost automated tape library, providing an automated tape solution for a large variety of host environments. It complements the IBM 3495 by offering a smaller capacity (between 144 and 3040 cartridges) at lower price using the proven IBM 3495 architecture. It is an ideal solution to meet the requirements of tape automation for both single- and multiple-platform environments.

A given configuration consists of one to sixteen frames (one control unit frame and any combination of storage and drive unit frames up to a total of sixteen). A variety of frame types are available to customize the library capabilities. Three basic models of the IBM 3494 Tape Library Dataserver combine to make up the library:

- Control unit frame (also referred to as the *library unit*), which contains one IBM 3490E-C1A or C2A, or one or two IBM 3590-B1A drives
- Zero to fifteen optional storage unit frames
- Zero to eleven optional drive unit frames, which can contain one IBM 3490E-C1A or C2A, or up to six IBM 3590-B1A drives. IBM 3490-C1A or C2A can be housed only within the first eight frames.

The IBM 3494 Tape Library Dataserver will support a maximum of sixteen tape control unit connections: each IBM 3590-B1A (when attached without an IBM 3590-A00) use one control unit connection, as does each IBM 3590-A00 (with any number of IBM 3590-B1As attached) and each IBM 3490-C1A or C2A. Thus the maximum number of tape drives supported in a single library depends on the mixture of tape drive models installed.

Figure 7 on page 11 shows the major hardware components of the IBM 3494:

1. Control unit frame

2. Drive unit frame
3. Storage unit frame
4. Convenience I/O station
5. Cartridge storage
6. Library Manager.

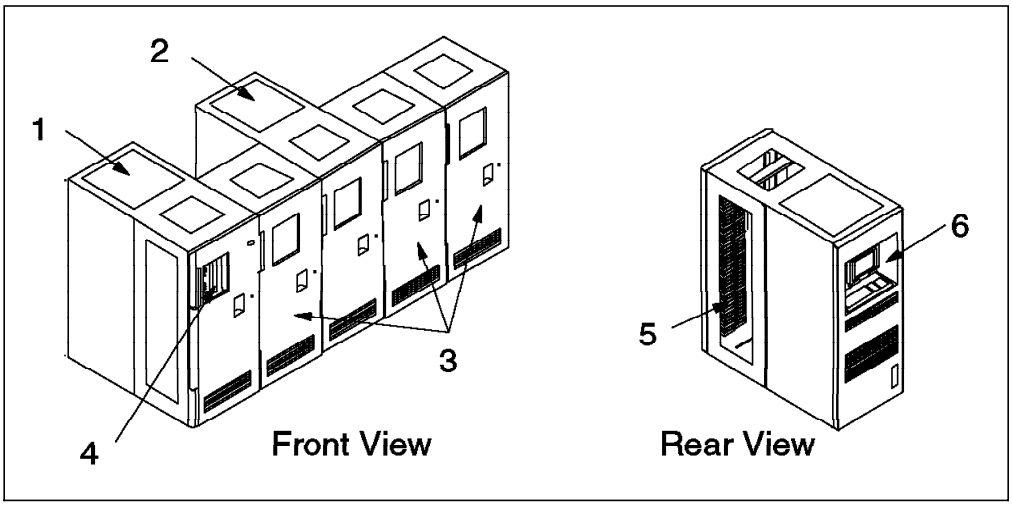

Figure 7. IBM 3494 Tape Library Dataserver Components

Figure 8 shows the IBM 3494 configuration possibilities:

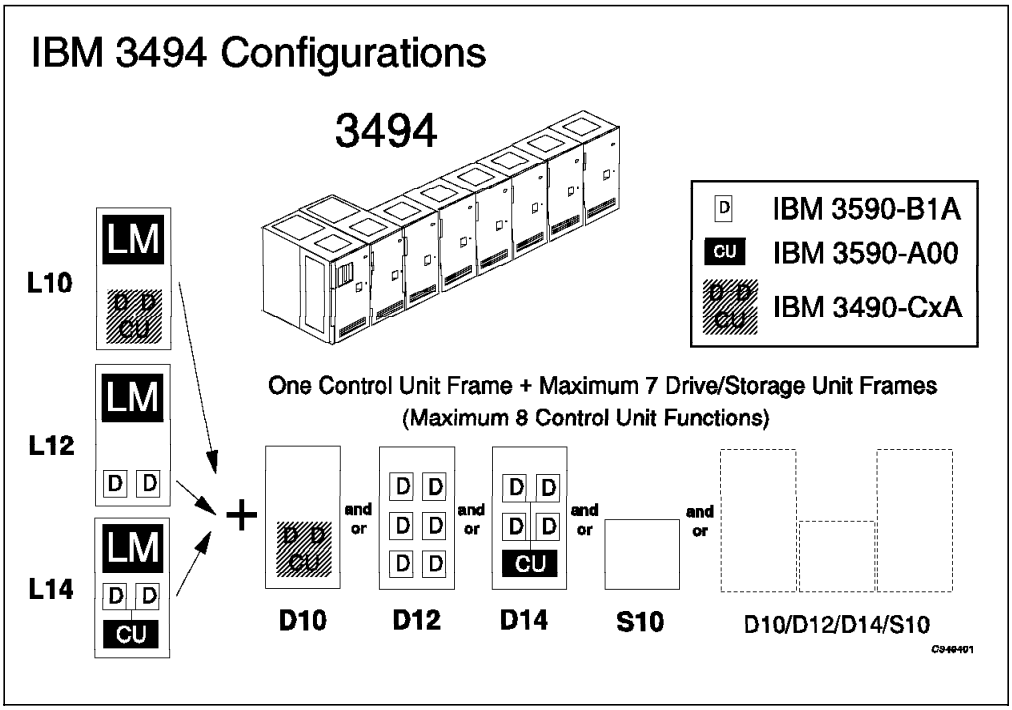

Figure 8. IBM 3494 Tape Library Dataserver Configurations

2.2.1 Control Unit Frames

The following control unit frames are available: IBM 3494 model L10, model L12, and model L14. Each control unit frame can contain cartridge storage cells in addition to tape drives and a control unit.

2.2.1.1 IBM 3494 Model L10 (Parallel, ESCON, and SCSI)

The original model of the IBM 3494 library is the L10. The library and drive units house one or another of the 3490-CxA models, containing one or two drives and a single integrated control unit. It is not possible in this configuration to exceed eight 3490-CxA integrated control units in a single library. Two IBM 3494-D12 or IBM 3494-D14 frames and two IBM 3494-S10 frames can be added to the base eight frames for a total of 12 frames. An additional two IBM 3494-D12 or IBM 3494-D114 frames and two IBM 3494-S10 frames can be added to a total of sixteen frames.

An IBM 3490-CxA can be attached to host systems using any combination of two ESCON, parallel, or SCSI adapters. However, only one type of adapter of an IBM 3490-CxA can be used for attaching to any single host system.

2.2.1.2 IBM 3494 Model L12 (SCSI Only)

The first new model of the IBM 3494 library is the L12. The library control-unit frame houses a maximum of two IBM 3590-B1A drives, and the drive-unit frame houses a maximum of six IBM 3590-B1A drives. Each IBM 3590-B1A drive has its own integrated tape control unit. Up to 16 control unit functions can be connected.

Note: The six IBM 3590-B1A drives do not have to be installed in a single unit, they can be distributed across drive units (frames) provided that the total number of control unit functions does not exceed sixteen.

Each IBM 3590-B1A can be attached to host systems using one or two SCSI adapters. The IBM 3590-B1A does not support any other host interface.

2.2.1.3 IBM 3494 Model L14 (ESCON Only)

The second new model of the IBM 3494 library is the L14. The library control-unit frame houses a maximum of two IBM 3590-B1A drives controlled by an IBM 3590-A00, and the drive-unit frame houses a maximum of four IBM 3590-B1A drives controlled by an IBM 3590-A00. With the IBM 3590-A00 installed, each library or drive unit uses only one control-unit attachment. Thus, with one library unit and eleven drive units (housing a total of 46 drives) the number of installed tape drives will be at the maximum.

Each IBM 3590-A00 is attached to host systems using the two ESCON adapters. The IBM 3590-A00 does not support any other host interface.

2.2.2 Drive Unit Frames

The following drive unit frames are available:

IBM 3494-D10 (Parallel, ESCON and SCSI) Contains one IBM 3490-CxA and cartridge storage cells.

IBM 3494-D12 (SCSI only) Contains a minimum of zero and a maximum of six IBM 3590-B1A tape devices along with cartridge storage cells.

IBM 3494-D14 (ESCON only) Contains zero or one IBM 3590-A00 tape control unit, a minimum of zero and a maximum of four IBM 3590-B1A tape devices, and cartridge storage cells. The IBM 3590-A00 is required if an IBM 3590-B1A is installed in the frame.

2.2.3 Storage Unit Frame

The IBM 3494 model S10 contains only cartridge storage cells.

2.2.4 Virtual Tape Server Unit Frame

IBM 3494-B16 contains the IBM Magstar Virtual Tape Server. One IBM 3494-B16 can be installed in a IBM 3494 and must be attached to the right of a IBM 3494-D12 within the first eight frames. The IBM 3494-B16 includes the tape volume cache and the VTS controller. The IBM 3494-D12 connected to the left of the IBM 3494-B16 houses three or six IBM 3590-B1A drives.

2.2.5 Mixed Tape Drive Configurations

IBM 3490E and 3590 tape technology can coexist in the same IBM 3494. Since a great many configurations are possible, careful planning is needed.

The number of tape drives that can be installed in an IBM 3494 library depends on the model; it can also be limited by the number of internal communication paths with the Library Manager. Eight paths are available, and the different subsystems have different requirements:

- One path for each IBM 3490E-C1A or 3490E-C2A
- One path for each IBM 3590-A00 (including its attached drives)
- One path for each direct-SCSI-attached IBM 3590-B1A.

In the past, with the IBM 3490-CxA, it was not possible to exceed the supported number of control units, because no more than eight control units could be installed in the maximum eight IBM 3494 frames. Now, a single drive unit frame can accommodate six native SCSI-attached IBM 3590-B1A drives, each with its own integrated control unit.

As a result, using only IBM 3490-CxAs or direct-SCSI-attached IBM 3590-B1A drives, for example, the maximum number of drives that can be installed in an IBM 3494 library is 16. Using ESCON-attached IBM 3590-B1A drives through the IBM 3590-A00, however, up to 46 drives can be installed. Many mixed configurations are possible, provided that the total number of paths to the Library Manager does not exceed sixteen.

It is easy to see that with different hosts and platforms sharing a mixed configuration of IBM 3490-CxA and IBM 3590-B1A, it is necessary to exercise care in planning the IBM 3494 configuration.

An individual IBM 3590-B1A can have only one type of channel attachment, either two ESCON adapters (using the IBM 3590-A00) or two SCSI adapters, but not one of each. This may be important when sharing tape drives between different platforms using different channel protocols. IBM 3490-CxA models can be configured with any combination of channel adapters (two in total for any one IBM 3490-CxA), ESCON, parallel, or SCSI. So, although a tape drive can only be online to one host at a time, and any one host must ″see″ a control unit as either ESCON, parallel, or SCSI attached, it is possible to attach one model CxA control unit to two different hosts using different channel interfaces and then switch the

tape drives between the two hosts as required. However, this scenario is not possible with an IBM 3590-B1A tape drive.

For further information on issues regarding the configuration of tape subsystems, please see the following: *IBM 3494 Introduction and Planning Guide*, *Magstar and IBM 3590 High Performance Tape Subsystem Technical Guide*, *Magstar and IBM 3590 High Performance Tape Subsystem: Multiplatform Implementation*.

2.2.6 Host Systems and Connections

The IBM 3494 can attach to the following processors:

- AS/400 9404/9406, all models
- RISC System/6000 models that support the
  - S/390 ESCON Channel Emulator
  - System/370 Channel Emulator/A
  - IBM SCSI-2 Differential High Performance Controller
  - IBM SCSI-2 Differential Fast/Wide Adapter/A
- POWERparallel SP2
- All ESA-capable S/370 and S/390 systems
- IBM 9672 System/390 Parallel Server
- ES/9000 models that support ESA/390
- ES/3090-9000T models that support ESA/370
- ES/3090 (Models E, S, J, JH, and T that support ESA/370)
- ES/4381 (Models 90E, 91E, and 92E that support ESA/370)
- SUN processors that support the SPARC operating system.

In terms of connecting to the host, the 3490E models C1A and C2A support the attachment of one or two channel adapters. The channel adapter types are:

- ESCON channel adapter
- Parallel channel adapter
- SCSI-2 adapter.

Any adapter combinations (up to two) of ESCON channel, parallel channel, or SCSI-2 adapters are allowed. One ESCON channel adapter provides one physical path or 16 logical paths with an ESCON Director, EMIF, or both.

In terms of connecting to the host, the IBM 3590-A00 is attached to the host using one or two ESCON adapters. Each of its two ESCON channel adapters provides 64 logical paths with an ESCON Director, EMIF, or both.

We discuss ESCON considerations later in this chapter.

The IBM 3590-B1A is attached to the host using one or two SCSI-2 adapters. The maximum SCSI channel distance supported is 25 m. This is a standard SCSI limitation rather than a limitation of the IBM 3590-B1A.

Host system software also communicates with the Library Manager for controlling the IBM 3494. This communication is done through an ESCON channel, parallel channel, RS-232, or LAN attachment.

MVS/ESA, VM/ESA, AIX/6000 (non-SCSI), AIX/ESA, and TPF send and receive library control information through their system-attached ESCON or parallel channels to the tape control unit, which passes the information to the Library Manager.

An OS/400 with a parallel or SCSI-2 data attachment, and an AIX/6000 with a SCSI-2 differential data attachment require an RS-232 or LAN link to pass library control information. VSE/ESA uses a LAN link to pass library control information and ESCON or parallel channels to transfer data. The LAN networks supported by the Library Manager are Token-Ring and Ethernet, using either APPC or TCP/IP.

We discuss the attachments for each host system in more detail later in this book.

Table 3 on page 16 summarizes the IBM 3494 connections to the host systems.

Table 3. Host System Connections: IBM 3494

Host System	For Data Transfer			For Library Control			
	ESCON	Parallel•	SCSI-2	ESCON	Parallel•	RS-232	LAN
ES/9000	X	---	---	X•	---	---	---
ES/9000	---	X	---	---	X•	---	---
ES/9000•	X	---	---	---	---	---	X•
ES/9000•	---	X	---	---	---	---	X•
S/390 Parallel Server	X	---	---	X•	---	---	---
S/390 Parallel Server	---	X	---	---	X•	---	---
S/390 Parallel Server•	X	---	---	---	---	---	X•
S/390 Parallel Server•	---	X	---	---	---	---	X•
ESA-capable	X	---	---	X•	---	---	---
ESA-capable	---	X	---	---	X•	---	---
ESA-capable•	X	---	---	---	---	---	X•
ESA-capable•	---	X	---	---	---	---	X•
AS/400	---	X	---	---	---	X	---
AS/400	---	X	---	---	---	---	X
AS/400	---	---	X	---	---	X	---
AS/400	---	---	X	---	---	---	X
RS/6000	X•	---	---	X• •	---	---	---
RS/6000	---	X	---	---	X•	---	---
RS/6000	---	---	X	---	---	X	---
RS/6000	---	---	X	---	---	---	X
POWERparallel SP2	X•	---	---	X• •	---	---	---
POWERparallel SP2	---	X	---	---	X•	---	---
POWERparallel SP2	---	---	X	---	---	X	---
POWERparallel SP2	---	---	X	---	---.	---	X
SUN	---	---	X	---	---	X	---
SUN	---	---	X	---	---.	---	X

Notes:

1. Parallel attachment is not supported for the IBM 3590.
2. Use same path as for data transfer.
3. For VSE/ESA only
4. Use APPC only
5. The IBM 3590 cannot be attached to RISC/6000 and SP2 through ESCON channels.

2.2.7 Configuration Goals

You can configure the IBM 3494 in many ways. Each combination offers a different balance between the overall performance of the IBM 3494 and the number of tape cartridges it can contain. For example, if you want to maximize the number of cartridges, you would configure the IBM 3494 with seven storage frames (the maximum number of frames always being eight). Figure 9 shows some sample configurations of the IBM 3494.

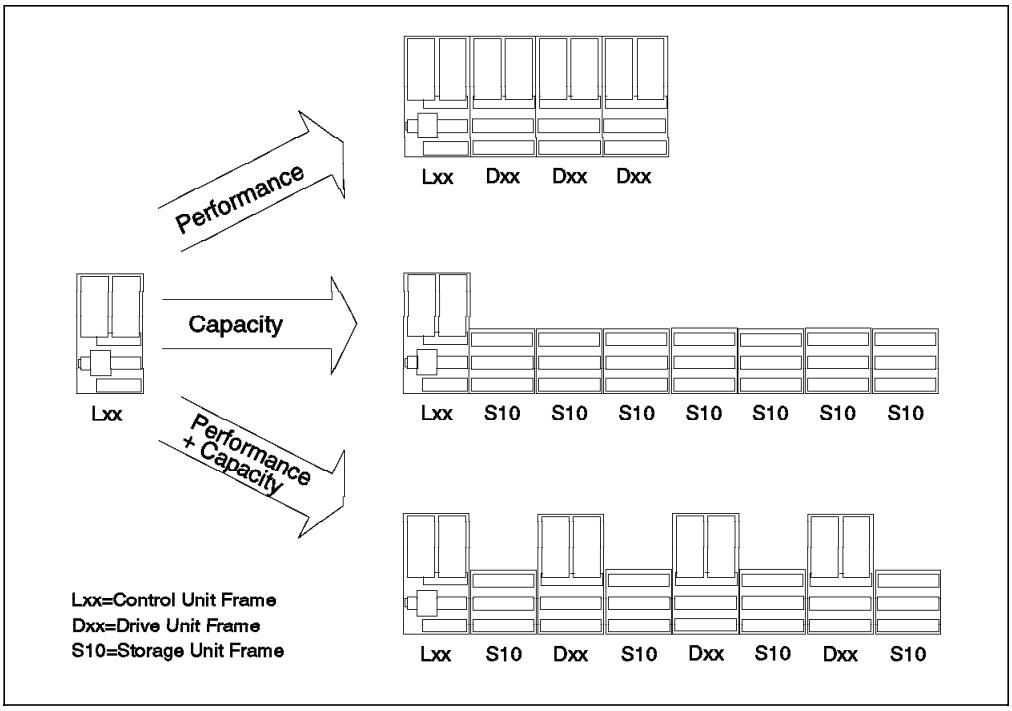

Figure 9. Sample Configurations: IBM 3494

2.2.8 Tape Drive Configurations and Cartridge Capacities

Inside a single IBM 3494, you can intermix IBM 3490-CxA tape drives, attached through SCSI, parallel, or ESCON channels, and IBM 3590-B1A tape drives attached through SCSI channels or by way of the IBM 3590-A00 tape controller through ESCON channels. Table 4 lists sample combinations and the maximum number of tape drives for each combination.

Table 4 (Page 1 of 2). Tape Subsystem Host Attachment Options for IBM 3494 — Maximum Number of Tape Drives

3490-CxA (All)	3590-B1A (SCSI)	3590-A00 (ESCON)	3490 Drives•	3590 SCSI Drives•	3590 ESCON Drives•	Total No. of Drives•
0	0	12	0	0	46*	46*
0	5	11	0	5*	44	47*
0	6	10	0	6	40	46
0	7	9	0	7	36	43
0	8	8	0	8	32	40
0	9	7	0	9	28	37
0	10	6	0	10	24	34

Table 4 (Page 2 of 2). Tape Subsystem Host Attachment Options for IBM 3494 — Maximum Number of Tape Drives

3490-CxA (All)	3590-B1A (SCSI)	3590-A00 (ESCON)	3490 Drives•	3590 SCSI Drives•	3590 ESCON Drives•	Total No. of Drives•
0	11	5	0	11	20	31
0	12	4	0	12	16	28
0	13	3	0	13	12	25
0	14	2	0	14	8	22
0	15	1	0	15	4	19
0	16	0	0	16	0	16
8	0	4	2	0	16*	32*
8	5	3	2	5	12*	33*
8	6	2	2	6	8*	30*
8	7	1	2	7	4*	27*
8	8	0	2	8	0*	24*

Notes:

- The IBM 3490 Model C1A has one drive, the Model C2A has two drives.
- If an IBM 3590 tape subsystem-B1A is installed in the Control Unit Frame, only two tape drives are supported. Reduce the maximum number to two only for configurations marked with an *.
- If an IBM 3590 tape subsystem is installed in the Control Unit Frame, only two tape drives are supported. Reduce the maximum number by two except for configurations marked with an *.
- The maximum number must be reduced by two, if one IBM 3590-A00 is installed in the Control Unit Frame. This has been taken into account where the maximum number is marked with an *.

Inside a single IBM 3494, you can install only one IBM 3494-B16 Virtual Tape Server. When you install the IBM 3494-B16 into an IBM 3494, because IBM 3494-B16 needs one RS-232 connection, the maximum configuration in a IBM 3494 is 4 RS-232 connections and 12 RS-422 connections. The IBM 3494-B16 also needs two RS-422 connections. And each IBM 3590-B1A drive attached to IBM 3494-B16 needs one RS-422 connection. Depending on whether three or six tape drives are installed in the IBM 3590-D12 frame attached to the Virtual Tape Server, four or seven additional RS-422 connections are available. In case of the Virtual Tape Server with six tape drives installed, four additional RS-422 connections are available. Table 5 lists all possible combinations and the maximum number of tape drives for a maximum of four RS-422 connections.

Table 5 (Page 1 of 3). Tape Subsystem Host Attachment Options for IBM 3494 — Four RS-422 Connections Available

3490-CxA (All)	3590-B1A (SCSI)	3590-A00 (ESCON)	3490 Drives•	3590 SCSI Drives	3590 ESCON Drives•	Total No. of Drives•
0	0	4	0	0	4–16	4–16
0	1	3	0	1	3–12	4–13
0	2	2	0	2	2–8	4–10
0	3	1	0	3	1–4	4–7

Table 5 (Page 2 of 3). Tape Subsystem Host Attachment Options for IBM 3494 — Four RS-422 Connections Available

3490-CxA (All)	3590-B1A (SCSI)	3590-A00 (ESCON)	3490 Drives•	3590 SCSI Drives	3590 ESCON Drives•	Total No. of Drives•
0	4	0	0	4	0	4
1	0	3	1– 2	0	3– 1 2	4– 1 2
1	1	2	1– 2	1	2– 8	4– 1 1
1	2	1	1– 2	2	1– 4	4– 8
1	3	0	1– 2	3	0	4– 5
2	0	2	2– 4	0	2– 8	4– 1 2
2	1	1	2– 4	1	1– 4	6– 9
2	2	0	2– 4	2	0	4– 6
3	0	1	3– 6	0	1– 4	4– 1 0
3	1	0	3– 6	1	0	4– 7
1	5	2	1– 2	5	2– 8	8– 1 5
1	6	1	1– 2	6	1– 4	8– 1 2
1	7	0	1– 2	7	0	8– 9
2	0	6	2– 4	0	6– 2 4	8– 2 8
2	1	5	2– 4	1	5– 2 0	8– 2 5
2	2	4	2– 4	2	4– 1 6	8– 2 2
2	3	3	2– 4	3	3– 1 2	8– 1 9
2	4	2	2– 4	4	2– 8	8– 1 6
2	5	1	2– 4	5	1– 4	8– 1 3
2	6	0	2– 4	6	0	8– 1 0
3	0	5	3– 6	0	5– 2 0	8– 2 6
3	1	4	3– 6	1	4– 1 6	8– 2 3
3	2	3	3– 6	2	3– 1 2	8– 2 0
3	3	2	3– 6	3	2– 8	8– 1 7
3	4	1	3– 6	4	1– 4	8– 1 4
3	5	0	3– 6	5	0	8– 1 1
4	0	4	4– 8	0	4– 1 6	8– 2 4
4	1	3	4– 8	1	3– 1 2	8– 2 1
4	2	2	4– 8	2	2– 8	8– 1 8
4	3	1	4– 8	3	1– 4	8– 2 3
5	0	3	5– 1 0	0	3– 1 2	8– 2 2
5	1	2	5– 1 0	1	2– 8	8– 1 9
5	2	1	5– 1 0	2	1– 4	8– 1 6
5	3	0	5– 1 0	3	0	8– 1 3
6	0	2	6– 1 2	0	2– 8	8– 2 0
6	1	1	6– 1 2	1	1– 4	8– 1 7
6	2	0	6– 1 2	2	0	8– 1 4
7	0	1	7– 1 4	0	1– 4	8– 1 8

Table 5 (Page 3 of 3). Tape Subsystem Host Attachment Options for IBM 3494 — Four RS-422 Connections Available

3490-CxA (All)	3590-B1A (SCSI)	3590-A00 (ESCON)	3490 Drives•	3590 SCSI Drives	3590 ESCON Drives•	Total No. of Drives•
7	1	0	7–14	1	0	8–15
8	0	0	8–16	0	0	8–16

Notes:

1. The IBM 3490-C1A has one drive; the IBM 3490-C2A has two drives.
2. If an IBM 3590 tape subsystem is installed in the Control Unit Frame, only two tape drives are supported.
3. The maximum number must be reduced by two, if one IBM 3590-A00 is installed in the Control Unit Frame.

In case of the Virtual Tape Server with three tape drives installed, seven additional control unit connections are available. Table 6 lists all possible combinations and the maximum number of tape drives for a maximum of seven RS-422 connections.

Table 6 (Page 1 of 2). Tape Subsystem Host Attachment Options for IBM 3494 — Seven RS-422 Connections Available

3490-CxA (All)	3590-B1A (SCSI)	3590-A00 (ESCON)	3490 Drives•	3590 SCSI Drives	3590 ESCON Drives•	Total No. of Drives•
0	0	7	0	0	7–38	7–28
0	1	6	0	1	6–24	7–25
0	2	5	0	2	5–20	7–22
0	3	4	0	3	4–16	7–19
0	4	3	0	4	3–12	7–16
0	5	2	0	5	2–8	7–13
0	6	1	0	6	1–4	7–10
0	7	0	0	7	0	7
1	0	6	1–2	0	4–24	7–26
1	1	5	1–2	1	5–20	7–23
1	2	4	1–2	2	4–16	7–20
1	3	3	1–2	3	3–2	7–17
1	4	2	1–2	4	2–8	7–14
1	5	1	1–2	5	1–4	1–11
1	6	0	1–2	6	0	7–7
2	0	5	2–4	0	5–20	7–24
2	1	4	2–4	1	4–16	7–21
2	2	3	2–4	2	3–12	7–18
2	3	2	2–4	3	2–8	7–15
2	4	1	2–4	4	1–4	7–12
2	5	0	2–4	5	0	7–9
3	0	4	3–6	0	4–16	7–22

Table 6 (Page 2 of 2). Tape Subsystem Host Attachment Options for IBM 3494 — Seven RS-422 Connections Available

3490-CxA (All)	3590-B1A (SCSI)	3590-A00 (ESCON)	3490 Drives•	3590 SCSI Drives	3590 ESCON Drives•	Total No. of Drives•
3	1	3	3–6	1	3–12	7–19
3	2	2	3–6	2	2–8	7–16
3	3	1	3–6	3	1–4	7–13
3	4	0	3–6	4	0	7–10
4	0	3	4–8	0	3–12	7–20
4	1	2	4–8	1	2–8	7–17
4	2	1	4–8	2	1–4	7–14
4	3	0	4–8	3	0	7–11
4	3	1	4–8	3	1–4	8–23
5	0	2	5–10	0	2–8	7–18
5	1	1	5–10	1	1–4	7–15
5	2	0	5–10	2	0	7–12
6	0	1	6–12	0	1–4	7–16
6	1	0	6–12	1	0	7–13
7	0	0	14	0	0	14

Notes:

1. The IBM 3490-C1A has one drive; the IBM 3490-C2A has two drives.
2. If an IBM 3590 tape subsystem is installed in the Control Unit Frame, only two tape drives are supported.
3. If one IBM 3590-A00 is installed in the Control Unit Frame, the maximum number must be reduced by two.

The number of storage cells available in an IBM 3494 for storage of tape cartridges depends on the number and type of frames, and on whether the Convenience I/O station or the Dual Gripper Feature is installed. Table 7 on page 22 shows the storage capacity of each storage frame.

Table 7. IBM 3494 Cartridge Capacity		
Frame	**Without Dual Gripper**	**With Dual Gripper**
L10, L12, L14	240	216
L10, L12, L14 with Convenience I/O	210	190
L10, L12, L14 with Enhanced Capacity Conv. I/O	160	144
D10 without IBM 3490E drives	400	360
D10 with IBM 3490E drives	300	270
D12 without IBM 3590 drives	400	360
D12 with 1–2 IBM 3590 drives	335	305
D12 with 3–4 IBM 3590 drives	290	260
D12 with 5–6 IBM 3590 drives	250	230
D14 without IBM 3590 drives	400	360
D14 with 1–2 IBM 3590 drives	345	305
D14 with 3–4 IBM 3590 drives	305	275
S10	400	360

2.2.9 Features

Some special features of the IBM 3494 are:

- Convenience I/O station (optional)

  The basic Convenience I/O station allows up to 10 cartridges to be added or removed from the library without interrupting library operations. The Convenience I/O station is located in the front door of the library control unit, and its installation reduces the number of cartridges that can be stored in the library control unit by 30.

  The enhanced-capacity Convenience I/O station allows up to 30 cartridges to be added or removed from the library without interrupting library operations. The Convenience I/O station is located in the front door of the library control unit, and its installation reduces the number of cartridges that can be stored in the library control unit by 80.

  If neither a convenience I/O station nor a high capacity output station is installed, the IBM 3494 sets aside a single cell for input/output processing.

- High-capacity output station (optional)

  The high-capacity output station allows you to remove large numbers of cartridges from the library. Use of this facility does affect library operations. The high-capacity output station is defined by the IBM Service Representative and its capacity can range from 10 to 160 cartridges. The maximum number depends on whether you have the Dual Gripper function, and on how large your convenience I/O station is.

- Cartridge accessor

  The cartridge accessor is the device that selects and transports cartridges from their storage areas and I/O stations to the tape drives. The cartridge accessor moves on the horizontal and vertical axis along the length of the IBM 3494. It uses a rail system comprising two horizontal rails, one at the top, the other at the bottom of the IBM 3494. The part of the cartridge accessor which holds the cartridges is called the “gripper.” A vision system

(barcode reader) sits on top of the gripper and is designed to read the barcodes off the cartridge labels.

- Dual cartridge grippers (optional)

  A second gripper can be mounted on the cartridge accessor. The dual gripper enhances performance of the accessor in the IBM 3494 by eliminating the time required to return a demounted cartridge to the storage cell before mounting the next cartridge. This enhanced performance raises the overall performance of the IBM 3494. When you have the dual gripper installed, the IBM Service Representative can place the IBM 3494 in "floating home-cell" mode. This mode allows the accessor to store a cartridge in any empty cell instead of returning the cartridge to its original, or "fixed home-cell," position. The redundancy of the dual gripper hardware also improves data availability.

  Note: Cartridge storage capacity is reduced by 10 percent when the dual gripper feature is installed.

- Second disk drive for the Library Manager (optional)

  The second disk drive allows for a second copy of the Library Manager database and system files to be kept. All the data and statistics can be mirrored on the second disk drive. This feature will reduce the time required to recover should the primary disk drive fail. We strongly recommend that this feature be installed.

- Externally unlabeled tape support

  This function allows the operator to enter externally unlabeled tapes into the IBM 3494. The externally unlabeled tape must enter the library through the Convenience I/O station. The operator assigns an external label number and media type (standard, enhanced or 3590), via the Library Manager console. The library then accepts this tape as if it were externally labeled. All library functions are now available to the externally unlabeled tape. The Library Manager keeps track of such cartridges by their location only, with no barcode verification. Extreme care must be taken not to move an externally unlabeled tape during any open-door or manual activities. It is recommended that the externally unlabeled tape be ejected as soon as the job is completed.

- Stand-alone device function

  The stand-alone device function enables a transient mount operation that moves cartridges from the convenience I/O station directly to a specified drive without host intervention. This operation is called "mount-from-input-station."

  Mount-from-input-station is designed to be used with stand-alone software that does not issue mount commands, for example, stand-alone dump or initial program load (IPL) from a tape address. This function cannot be utilized with MVS or similar operating systems because the operating system picks the drive to be used and sends mount commands for the tape. Also, tapes processed using mount-from-input-station are not put in the Insert category, so operating systems like MVS will not be informed that the new cartridge is in the library.

- Remote Library Manager console

  The remote Library Manager console feature enables a customer to control or monitor the operations and status of up to eight Library Managers from a remote location. The remote Library Manager console can be located

anywhere on the customer-supplied LAN. Connection to the remote Library Manager console is password controlled. The customer also supplies the programmable workstation and software (for example, PS/2 and OS/2 with CM/2) required at the remote terminal location. A separate feature is required for each Library Manager that is to be connected to the LAN.

- Remote power sequencing for AS/400 (optional)

  The remote power sequencing feature permits power on/off sequencing by attached AS/400 host processors.

For further information on IBM 3494 features, please see *IBM 3494 Introduction and Planning Guide*.

2.3 IBM 3495

The IBM 3495 is designed to meet the needs of customers who want to automate a large number of cartridges. Four models provide a range of cartridge capacities from 5660 to 18940 storage cells:

IBM 3495-L20 5660–6480 storage cells, 2–16 drives

IBM 3495-L30 8460–10620 storage cells, 2–32 drives

IBM 3495-L40 11280–14780 storage cells, 2–52 drives (4–32 drives if all IBM 3590)

IBM 3495-L50 14100–18940 storage cells, 2–64 drives (4-32 drives if all IBM 3590).

Note: The IBM 3495 M10 Manual Tape Library Dataserver does not support IBM 3590 tape subsystems.

Figure 10 shows the major hardware components of the IBM 3495:

1. IBM 3490E, 3490, or 3590 tape subsystems
2. Cartridge accessor controller
3. Manual mode terminal
4. Library Manager
5. Convenience I/O station
6. Cartridge accessor
7. Cartridge storage.

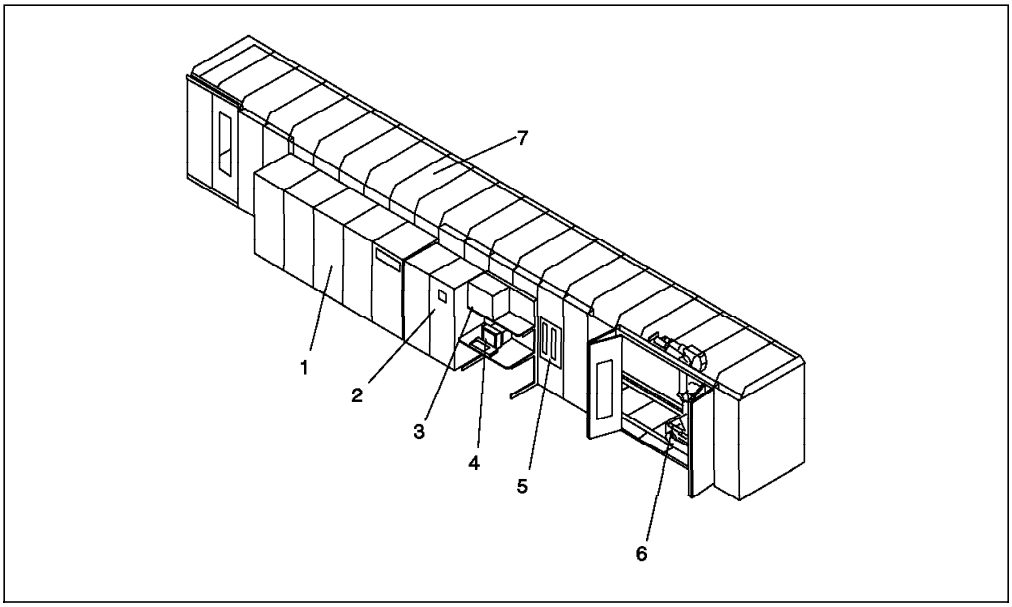

Figure 10. IBM 3495 Automated Tape Library Dataserver

2.3.1 Supported Tape Subsystems

The IBM 3495 supports a mix of 3490, 3490E and 3590 tape subsystems.

IBM 3490 models A01, A02, and IBM 3490E models A10, A20 are control units. IBM 3490 models B02, A04, and IBM 3490E models B20, A40 are drive units. Multiple drive units can be controlled by a single control unit. (The published and official minimum number of drives is four. However, since we find that B02 and B20 boxes, containing only two drives, have been successfully installed at customer sites, we include the B02 and B20 boxes in this document, for completeness.)

The IBM 3590 tape subsystem can be installed in the IBM 3495. An IBM 3590-A00 control unit and four IBM 3590-B1A drive units must be packaged within an IBM 3590-A14 frame as an IBM 3590 tape subsystem.

One IBM Magstar Virtual Tape Server subsystem can be installed into an IBM 3495. The 3495-B16 frame houses the Virtual Tape Server controller and the Tape Volume Cache. Adjacent to the IBM 3495-B16 frame, there must be one IBM 3590-A14 frame containing four IBM 3690-B1A drives. The IBM 3590-A14 used by an IBM Magstar Virtual Tape Server does not require an IBM 3590-A00 control unit.

Note: For further information about the IBM Magstar Virtual Tape Server, please see Appendix B, “The IBM Magstar Virtual Tape Server” on page 185 or Redbook, *The IBM Magstar Virtual Tape Server and Enhancements to Magstar: New Era in Tape*.

The number of tape drives that can be installed in an IBM 3495 library is model dependent, as shown above, but can also be limited by the number of internal communication paths with the Library Manager. A total of eight paths are available and the different subsystems have different requirements:

- One path for each IBM 3490-A01 or 3490-A10
- Two paths for each IBM 3490-A02 or 3490-A20
- One path for each IBM 3590-A00.

So, for example, using only IBM 3490 or 3490E subsystems, the maximum number of drives that can be installed in an IBM 3495 library is 64, whereas using only IBM 3590 subsystems, the maximum number of drives is 32. Mixed configurations are possible, provided that the total number of paths to the Library Manager does not exceed eight.

Table 8 shows the number of control unit functions (CUFs) and drives, the supporting recording technology, and data compression.

Table 8. Supported Tape Models

Tape Subsystem Model	3490				3490E				3590
	A01	A02	B02	B04	A10	A20	B20	B40	A00/B1A
Number of CUFs	1	2	-	-	1	2	-	-	1
Number of drives	-	-	2	4	-	-	2	4	4
Recording technology	-	-	18 track	18 track	-	-	36 track	36 track	128 track
Data compression	IDRC	IDRC	-	-	IDRC	IDRC	-	-	IBMLZ1

2.3.2 Host Systems

The IBM 3495 can attach to the following processors:

- RISC System/6000 models that support the S/390 ESCON Channel Emulator
- RISC System/6000 models that support the System/370 Channel Emulator/A
- POWERparallel SP2
- All ESA-capable System/370 and System/390 processors.
- IBM 9672 System/390 Parallel Server
- ES/9000 (all models that support ESA/390)
- ES/3090-9000T (all models that support ESA/370)
- ES/3090 (Models E, S, J, JH, and T that support ESA/370)
- ES/4381 (Models 90E, 91E, and 92E that support ESA/370).

2.3.3 Connection to Host System

The channel connections for the IBM Automated Tape Library are based on the 3490 capabilities. Therefore, there is no difference between a stand-alone 3490 tape subsystem and a tape subsystem inside the IBM 3495.

The IBM 3490 and 3490E models inside the IBM 3495 support ESCON and parallel channel adapters. These ESCON and parallel channels are used for both data transfer and Library Manager control.

The IBM 3590-A00 supports ESCON channel adapters only. These ESCON channels are used for both data transfer and Library Manager control.

Table 9 on page 28 shows the maximum attachment configurations of both ESCON and parallel channel adapters for the IBM 3490, 3490E, and 3590 tape subsystems.

Table 9. Maximum Attachment Configurations

Tape Controller	Maximum Attachment Configuration	
	ESCON	**Parallel**
IBM 3490-A01	2	0
	1	2
	0	4
IBM 3490-A02	4	0
	2	4
	0	8
IBM 3490-A10	4	0
	2	2
	0	4
IBM 3490-A20	8	0
	4	4
	0	8
IBM 3590-A00	2	0
IBM 3494-B16	2	0
IBM 3495-B16	2	0

Notes:

- For the IBM 3490 models A01 and A02, one ESCON adapter replaces two parallel adapters.
- The IBM 3490 models A02 and A20 contain two control unit functions (CUFs), and the ESCON and parallel adapters in these CUFs must be identical. For example, if CUF "0" has one ESCON adapter and three parallel adapters, CUF "1" must have one ESCON adapter and three parallel adapters.
- One ESCON adapter to IBM 3490 and 3490E tape subsystems provides one physical path or 16 logical channels with an ESCON Director and/or ESCON Multiple Image Facility (EMIF).
- One ESCON adapter to IBM 3590 tape subsystems provides one physical path or 64 logical channels with an ESCON Director and/or ESCON Multiple Image Facility (EMIF).

Table 10 summarizes the IBM 3495 connections to the host systems.

Table 10. Host System Connections: IBM 3495

Channel Type	Host System		
	ES/9000, S/390 Parallel Server, ESA-capable	**AS/400**	**RISC System/6000, POWERparallel SP2**
ESCON	X	---	X•
Parallel	X•	---	X•

Notes:

1. The IBM 3590 cannot be attached through ESCON channels.
2. The IBM 3590 does not have parallel attachment.

2.3.4 Configuration and Capacity

Table 11 shows the maximum number of IBM 3490 and 3490E A-boxes and B-boxes for each model of the IBM 3495. An IBM 3490 and 3490E subsystem includes one A-box and at least one B-box.

Table 11. Configuration Summary for IBM 3490 and 3490E

	3495-L20	**3495-L30**	**3495-L40**	**3495-L50**
Maximum CUFs for this IBM 3495 model	4	8	8	8
Maximum number of IBM 3490 and 3490E Subsystems	2	3	4	4
Maximum number of A-boxes	2	3	4	4
Maximum number of B-boxes	4	8	13	16
Maximum number of drives	16	32	52	64

Table 12 shows the maximum number of IBM 3590 subsystems for each model of the IBM 3495. An IBM 3590-A14 within an IBM 3495 consists of an IBM 3590-A00 controlling four 3590-B1A drives.

Table 12. Configuration Summary for IBM 3590

	3495-L20	**3495-L30**	**3495-L40**	**3495-L50**
Maximum CUFs for the IBM 3495 model	4	8	8	8
Maximum number of IBM 3590 Subsystems	4	8	8	8
Maximum number of drives	16	32	32	32

Table 13 shows the maximum number of cartridges and the number of drives for each model of the IBM 3495.

Table 13. IBM 3495 Drive and Cartridge Capacity

Model	**Maximum Number of Cartridges**		**Number of Tape Drives**
	With Maximum Number of Drives	**With Minimum Number of Drives**	
IBM 3495-L20	5660	6480	2 to 16
IBM 3495-L30	8460	10620	2 to 32
IBM 3495-L40	11280	14780	2 to 52•
IBM 3495-L50	14100	18940	2 to 64•

Note:

1. The number of tape drives ranges from 4 to 32 if all drives are IBM 3590s.

In 2.3, “IBM 3495” on page 25, we described the maximum capacity of the four IBM 3495 models in terms of tape drives (64) and cartridges (18940). The maximum number of cartridges that can be stored in the IBM 3495 decreases as additional tape control and tape drive boxes are installed. The maximum number of cartridges that can be stored will also decrease if your IBM 3495 is configured with either an internal or external high-capacity I/O station.

When planning your configuration, you must take these factors into account and reach an acceptable balance between the number of channels, number of tape drives, and number of cartridges.

For further information on configuring the IBM 3495, please see the *IBM 3495 Introduction and Planning Guide*.

2.3.5 Features

The IBM 3495 has some special features:

- Convenience I/O stations

  There are two Convenience I/O stations: a 20-cartridge input and a 20-cartridge output station. They allow you to add or remove cartridges from the library without interrupting the operations of the IBM 3495.

- High-Capacity I/O stations (optional)

  These can be specified at installation time. They support the insertion of up to 260 cartridges and the ejection of up to 240 cartridges. Use of these stations does affect library operations: configuring your IBM 3495 with High-Capacity I/O stations reduces the number of cartridges that can be stored in the IBM 3495 by 500.

- External High-Capacity I/O station (optional)

  The external High-Capacity I/O station provides 240 I/O cells, which can be used either to insert or eject cartridges without interrupting the operation of your IBM 3495. All I/O cells can be used in either input mode or output mode at any one time. The High-Capacity I/O station cannot be activated when this feature is installed. Configuring your IBM 3495 with an External High-Capacity I/O station reduces the number of cartridges that can be stored in the IBM 3495 by 500.

- Dual Library Manager

  The Dual Library Manager feature provides a redundant library manager, which consists of a system unit, keyboard, and display. This feature improves availability to the data in the IBM Automated Tape Library. If the primary Library Manager fails, the second active library manager automatically takes control of the IBM Automated Tape Library.

- Remote Library Manager console

  The remote Library Manager console feature enables a customer to control or monitor the operations and status of up to eight Library Managers from a remote location. The remote Library Manager console can be located anywhere on the customer-supplied LAN. Connection to the remote Library Manager console is password-controlled. The customer also supplies the programmable workstation and software (for example, PS/2 and OS/2 with CM/2) required at the remote terminal location. A separate console is required for each Library Manager that is to be connected to the LAN. For example, if Dual Library Manager is installed, two Remote Library Manager consoles are required to monitor and control both Library Managers.

- Built-in manual mode terminal

  A terminal is provided inside the enclosure to assist the operator when the IBM 3495 is in manual mode. The manual mode terminal tells the operator which volumes to retrieve, the location of the volumes, and on which drives to mount the volumes.

- Use of ICL and ACF

  For scratch mounts, the IBM 3495 can use the IBM 3490 or 3490E tape subsystem Integrated Cartridge Loaders (ICL), or the IBM 3590 tape subsystem Automated Cartridge Facility devices (ACF). These can load scratch tapes in the tape drive in less than 7 seconds.

- Cartridge accessor

  The cartridge accessor is the device that selects and transports cartridges from their storage areas to the tape drive(s). The cartridge accessor in the IBM 3495 is a six-axis robotic arm that travels on a two-rail system along the length of the Library. The part of the cartridge accessor that holds the cartridges is called the grippers. A vision system (camera and lamp) that sits on top of the grippers is designed to read the barcodes off the cartridge labels, and is able to distinguish the two-tone ECCST cartridges from the monotone CST cartridges.

- Second camera and lamp (optional)

  A second camera and lamp can be provided for the vision system. This feature allows the vision system to continue operation if the primary camera or lamp assembly fails.

- Dual cartridge grippers

  Two cartridge grippers are mounted on the cartridge accessor. The dual gripper enhances performance of the accessor in the IBM 3495 by eliminating the time required to return a demounted cartridge to the storage cell before mounting the next cartridge. This enhanced performance raises the overall performance of the IBM 3495. The redundancy of the dual gripper hardware also improves data availability.

- Floating home-cell mode

  The IBM 3495 operates in floating home-cell mode during normal operations. Tape volumes are not preassigned, nor are they locked into specific, fixed storage cells. Therefore, the cartridge accessor spends less time moving from storage cell to drive or from drive to storage cell. This feature improves accessor performance.

Note: The IBM 3495 does not support externally unlabeled tapes, nor stand-alone device functions that are supported by IBM 3494. However, work-arounds are available if necessary: Putting the IBM 3495 into Manual mode lets you mount unlabeled tapes, and lets you use stand-alone functions. In Manual mode, the human operator becomes the vision system and cartridge accessor. Therefore, any externally unlabeled tape can be carried into the IBM 3495 and mounted in response to a host mount request. Unlabeled tapes must be removed from the IBM 3495 prior to resuming automatic mode. Please be aware that PC barcode print programs are available, and temporary barcoding of an unlabeled tape is less disruptive than putting the IBM 3495 into Manual Mode.

For further information on IBM 3495 features, please see the following: *IBM 3495 Introduction and Planning Guide*, *IBM 3495 Operator's Guide*.

2.4 IBM 3494 and 3495 Tape Library Dataservers: A Comparison

Table 14 on page 33 compares some special features of the IBM 3494 and 3495 Tape Library Dataservers.

Table 14. IBM 3494 and 3495 Tape Library Dataservers

	IBM 3494	**IBM 3495**
Cartridge capacity	210 to 6040•	5660 to 18940
Supported 3490 and 3490E models	3490E-C1A, 3490E-C2A	3490-A01, 3490E-A10, 3490-A02, 3490E-A20, 3490-B02, 3490-B04, 3490E-B20, 3490E-B40
Supported 3590 models	3590-B1A, 3590-A00	3590-B1A, 3590-A00, 3590-A14,
Number of tape drives	1 to 46	2 to 64
Convenience I/O station	Yes	Yes
High-capacity I/O facility	Output only	Yes
External high-capacity I/O station	No	Yes
Attachment (data path)	Parallel•, ESCON, SCSI-2	Parallel•, ESCON
Attachment (library control)	Parallel, ESCON, RS-232, LAN•	Parallel, ESCON
Maximum number of host attachments (physical channel)	24	32
Supported host systems	AS/400, ES/9000, ESA-capable, S/390 Parallel Server, RISC System/6000, POWERparallel SP2, SUN	ES/9000, ESA-capable, S/390 Parallel Server, RISC System/6000, POWERparallel SP2
ICL support	No	Yes
Floating home cell mode	Yes•	Yes
Dual cartridge grippers	Yes	Yes
Built-in manual mode terminal	No•	Yes
Dual Library Manager	No	Yes
Remote Library Manager console	Yes	Yes
Externally unlabeled tape support	Yes	No
Stand-alone device function	Yes	No
Remote power sequencing for AS/400	Yes	No

Notes:

1. Cartridge storage capacity is reduced by 10% when the dual gripper feature is installed.
2. Parallel attachment is not supported for the IBM 3590.
3. Token-Ring and/or Ethernet
4. Only if dual cartridge gripper feature is installed
5. The Library Manager of the IBM 3494 can be used as a manual mode terminal in manual mode.

2.5 Configuration Considerations

In this section, we describe some general configuration guidelines for sharing and partitioning IBM Automated Tape Library.

2.5.1 PR/SM and EMIF

In an ES/9000 environment, the Processor Resource/System Manager (PR/SM) and ESCON Multiple Image Facility (EMIF) provide special capabilities.

The PR/SM provides support for logical partitions on a single processor. The EMIF provides ESCON channel sharing capabilities to reduce the number of ESCON channels and ESCON Director ports required to support PR/SM logical partitions on a single machine, thus lowering the total cost of computing.

2.5.2 ESCON Considerations

The considerations for ESCON are as follows:

- Supported distances

  The supported distance between a subsystem control unit and a host is limited by the communication protocols and the timing of the signals passed between the host and control unit. The IBM 3590 Tape Control Unit is designed to support a maximum ESCON channel distance of 60 km. However, with the current ESCON implementations a distance of only 43 km is possible (with an ESCON extended distance facility (XDF) channel, using a 20-km single-mode link to a director; a second 20-km single-mode link to a second director; and a final 3 km multimode LED link to the tape subsystem).

- Logical paths

  An IBM 3590-A00 has two ESCON physical paths to an ES/9000 or S/390 Parallel Server host, each of which can have 64 logical paths, a total of 128 logical paths defined for the control unit. Only two of these paths can be concurrently active. Compare this with the IBM 3490-A20, for example, which has a maximum of eight ESCON physical paths to an ES/9000 host or hosts, each of which can have 16 logical paths giving a total of 128 logical paths defined for the control unit. Again, only two of these paths can be concurrently active.

  Note: Do not confuse the number of logical paths supported by an ESCON control unit with the number of paths that can be defined from a system image to a single device. The processor complex channel subsystem (CSS) determines the number of paths that can be defined between a system image and a single device. The number of paths to a device depends on the processor type and model. ES/9000 711-based processors, 520-based processors, and 511-based processors can define up to eight physical channel paths to a device. All other ES/9000 and ES/3090 processors can define up to four paths to a device. This limit is enforced by the I/O configuration program (IOCP) and the hardware configuration definition (HCD).

2.5.3 Multiple Tape Libraries

For large customers who want to use two or more IBM Automated Tape Library in a single- or multiple-host environment, there are no special considerations. Each host system must have one connection to each IBM Automated Tape Library and be assigned one tape drive inside each IBM Automated Tape Library. If every host is not assigned to a tape drive, the host systems cannot use the IBM Automated Tape Library concurrently.

2.5.4 Number of Tape Drives and Channels

The host system can use only those tape drives that are connected through the tape control unit. The number of drives and channels for the tape subsystem inside the IBM Automated Tape Library must be taken into consideration.

When sharing and/or partitioning an IBM 3494 that is used by two or more host systems, we recommend that additional drive unit frames be added so that one host system can connect to two tape subsystems.

The IBM 3494 can contain up to sixteen control unit functions whereas the IBM 3495 currently can have no more than eight control unit functions. However, the IBM 3495 can be configured with more physical data channels (32) than the IBM 3494 (24).

2.5.5 Availability

If you are sharing and partitioning one IBM Automated Tape Library used by two or more host systems, higher availability is required, and some general configuration guidelines for disaster recovery apply.

The Library Manager controls all activity within the IBM Automated Tape Library and manages the actual physical location of the volumes in the library. If the Library Manager is down, the IBM Automated Tape Library is not available, and all host systems cannot use its volumes. Therefore, we recommend that you install the dual Library Manager feature for the IBM 3495 and/or the second disk drive for Library Manager feature for the IBM 3494. These features provide higher availability of the Library Manager.

The host system can use only those tape drives that are connected through the tape control unit. In each tape subsystem, if the control unit function fails, all attached tape drives become unavailable. We recommend that you configure the IBM 3494 or IBM 3495 to have two or more tape subsystems, and that each host system be attached to a minimum of two tape control units.

Chapter 3. Software Environments

To use the IBM Automated Tape Library, in addition to device support for 3490 and 3490E (and 3590 if applicable) tape subsystems, you must have software that can communicate with the Library Manager to control the tape library. In this chapter we describe briefly the host software environments that provide this support. These are:

- MVS/ESA using system-managed tape
- MVS/ESA using Basic Tape Library Support
- VM/ESA using DFSMS/VM
- MVS/ESA as a guest of VM/ESA
- VSE/ESA using VSE Guest support under VM/ESA
- VSE/ESA using Library Control Device Driver for VSE/ESA
- AIX/6000 and optionally using ADSM/6000
- OS/400 and optionally using Backup Recovery and Media Services/400
- Transaction Processing Facility (TPF).

We give brief information here on each environment and direct you to other publications for more information. We highlight the areas that may affect the sharing, or the partitioning (or both) of IBM Automated Tape Librarys.

AIX/ESA Version 2 Release 2.0 and later releases, and SUN operating system (SunOS 5.x, Solaris 2.2 or later releases) can also support the IBM 3494, but we do not describe them in this book.

If you are already familiar with the software environments in your situation, you may want to skip this chapter.

3.1 MVS/ESA and System-Managed Tape

In this section we discuss the system-managed tape environment. If you want to use an IBM Automated Tape Library in an MVS/ESA environment without system-managed tape, please refer to 3.2, “MVS/ESA and Basic Tape Library Support” on page 41.

3.1.1 Overview

System-managed tape allows you to manage tape volumes and IBM Automated Tape Librarys using a set of policies that determine the kind of service that is to be given to the data sets on the volume.

The automatic class selection (ACS) routines process every new tape allocation in the system-managed storage (SMS) address space. The production ACS routines are stored in the ACDS (active control data set). These routines allocate a set of classes to each volume that reflect your installation′s policies for the data on that volume. The ACS routines also direct the volume to a storage group.

The storage class routine determines whether or not a request is SMS-managed. If a storage class is not assigned, the request is not SMS-managed.

For SMS-managed requests, the storage group routine assigns the request to a storage group. This determines which IBM Automated Tape Library are to be used. A tape storage group is a collection of tape drives that are located within

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one or more tape libraries. One to eight library names can be associated with the tape storage group. Tape storage groups can be associated with one or more tape libraries, but all volumes of a multivolume data set *must* be contained within a single library and a single storage group.

For example, with system-managed tape you could:

- Direct all of your offsite backup volume allocations to an IBM Automated Tape Library in an offsite protected location for disaster recovery.
- Ensure that all volumes for a particular application are written on 18-track tape drives without compaction.

The ACS routines are invoked for every allocation. Tape allocations are passed to Object Access Method (OAM), which uses its Library Control System (LCS) component to communicate with the Library Manager. See Figure 11.

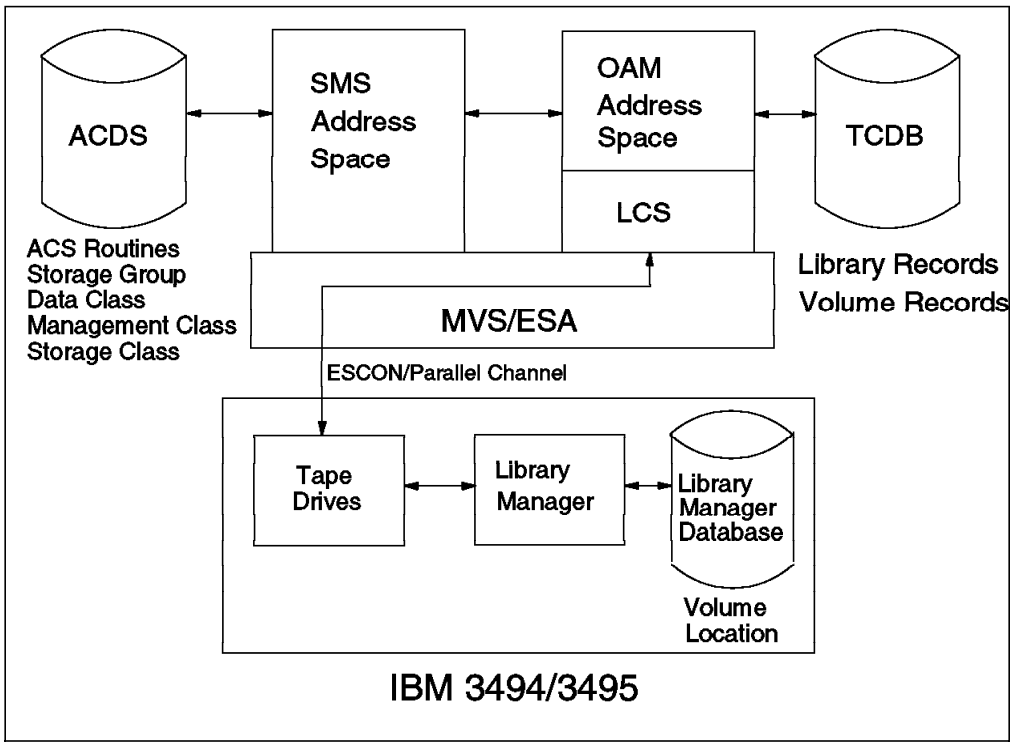

Figure 11. MVS/ESA and System-Managed Tape

3.1.2 Library Manager Interface

To use system-managed tape, the OAM address space must be active. Its LCS component interfaces with the IBM Automated Tape Library Library Manager.

For more information about OAM, see *DFSMS/MVS Version 1 Release 3 Object Access Method Planning, Installation and Storage Administration Guide for Tape Libraries*.

In addition, ACS routines must be defined to implement the installation policies by means of data class (DC), storage class (SC), and storage group (SG). These ACS routines must, at a minimum, direct data sets to volumes in IBM Automated Tape Librarys or Manual Tape Library Dataservers.

The external interface to an IBM Automated Tape Library is through:

- Interactive Storage Management Facility (ISMF) to work with the tape libraries and library resident volumes, and alter the tape configuration database (TCDB) entries. The following are typical functions:
  - Defining and Redefining tape libraries
  - Displaying tape library attributes
  - Altering tape library definitions
  - Copying tape library definitions
  - Deleting tape library definitions
  - Listing tape libraries and volumes
  - Displaying tape volumes
  - Auditing tape volumes and libraries
  - Altering tape volumes and libraries
  - Ejecting tape volumes.

  Note: Because Access Method Services (AMS) commands cannot change the Library Manager inventory in an IBM Automated Tape Library, ISMF should be used for normal tape library functions. The AMS CREATE, ALTER and DELETE commands should be used only to recover from volume catalog errors.
- MVS operator command, LIBRARY, to reenable exits, eject volumes, query and set ICLs or ACFs, and display the status of tape drives.
- MVS operator command, DISPLAY SMS, to display library information or data about a volume
- DFSMSrmm RMM TSO subcommand to manage tape volumes in the tape library
- The programming interface provided by the LCS External Services macro, CBRXLCS, for example, to query the name and type of the tape library in which a volume resides
- The installationwide exits (CBRUXENT, CBRUXEJC, CBRUXCUA, CBRUXVNL) to manage entry, exit, change use attribute, and volume-not-in-tape-library handling. Use of these exits is optional, depending on how your tape management system implements its IBM Automated Tape Library support.

  The functions of these exits that are pertinent to sharing and/or partitioning are:
  - Approving the entry of a volume entered into the IBM Automated Tape Library for this system's TCDB (CBRUXENT).
  - Disapproving the entry of a volume entered into the IBM Automated Tape Library (CBRUXENT).

The exits are provided with the DFSMSrmm component of DFSMS/MVS.

3.1.3 Control Data Sets

For system-managed tape, information about volumes is stored in the TCDB, which is an integrated catalog facility (ICF) catalog of the type VOLCAT. The TCDB is one or more *volume catalogs*. A volume catalog contains entries for tape volumes and tape libraries but does not contain entries for individual data sets. At least one general volume catalog must be defined, *high-level-qualifier*.**VOLCAT.VGENERAL**, and any number of specific volume catalogs, *high-level-qualifier*.**VOLCAT.Vx**, where x is the high-order character of the volume serial number. Storing the information for any particular range of

volume serial numbers in a separate VOLCAT—that is, a specific volume catalog—aids performance in accessing the TCDB.

For a full description of setting up system-managed tape for an IBM Automated Tape Library see *IBM 3495 Implementation Primer for MVS* and *MVS/ESA Storage Management Library: Implementing System-Managed Storage*.

3.1.4 Considerations

Here are some points to consider when you use an IBM Automated Tape Library in a system-managed tape environment:

- To use system-managed tape, DFSMS/MVS must be installed with the MVS/ESA operating system at level 4.3 or higher.
- MVS hardware configuration definition (HCD) uses the LIBRARY parameter to define drives configured to a tape library.
- A set of SMS systems can be grouped together by sharing SMS control data sets. This group is called an SMSplex. Up to eight SMS systems can be grouped together into an SMSplex when using DFSMS/MVS Version 1.1.

  DFSMS/MVS Version 1.2 introduced SMS system group name support to remove the eight-system limit in an SMSplex and allows up to 32 systems in a JES2 SMSplex. But that level of system group name support has some limitations, for example, it cannot be used in JES3 environments.

  DFSMS/MVS Version 1.3 introduced SMS 32-Name Support to remove the above limitations. SMS 32-Name Support requires JES3 Version 5.2.1 plus PTF (APAR OW12573).
- There is no limit to the number of libraries that can be attached to one system-managed tape system, but a Tape Storage Group can span only eight libraries.

  Note: If your IBM Automated Tape Library Dataserver does have a IBM Magstar Virtual Tape Server installed, the Tape Storage Group which refers to the IBM Magstar Virtual Tape Server must not span any other library.
- The TCDB is a control data set for SMS and must be shared in an SMSplex. Thus it is possible to allow access to a volume by more than one system in the SMSplex.
- All volumes should be SL (standard label) or AL (ANSI label) tapes. APARs OW01530 and OW02211 are available to support NL (nonlabeled) and BLP (bypass label processing) volumes for input processing and APARs OW05934 and OW06305 are available for output processing. These APARs have now been integrated into DFSMS/MVS V1.3.
- The following provide IBM 3590 Tape Technology software support: (The following are the minimum releases of software)
  - MVS/ESA SP 4.3 + SPE
  - MVS/ESA SP 5.1.0 + SPE
  - MVS/ESA SP 5.2.0 + SPE
  - JES3 4.2.1 + SPE
  - JES3 5.1.1 + SPE
  - JES3 5.2.1 + SPE
  - DFSMS/MVS 1.2.0 or higher + SPE
  - EREP 3.5.0 + PTF
  - ADSM for MVS in a future release

– DFSORT Release 13 + SPE
– DITTO/ESA Release 1.

Note:

Toleration PTFs will be required for DFSMS/MVS 1.1.0 and DFSMS/MVS 1.2.0 without the IBM 3590 Support SPE when sharing an IBM 3494 or 3495 Automated Tape Library Dataserver with DFSMS/MVS 1.2.0 that has the IBM 3590 SPE installed.

DFDSS V2.5 does not support the IBM 3590 but DFSMSdss 1.2.0 does.

- The IBM tape management system DFSMSrmm (Removable Media Manager) interfaces fully with the Library Manager. DFSMSrmm is IBM′s tape management system and is an optional feature of DFSMS/MVS. DFSMSrmm records all tape data set and volume information and provides utilities to perform expiration processing and vaulting; it retains information about volumes whether or not they are in a library, part of system-managed tape, onsite, or offsite.

  The program offering DFRMM is not supported by the system-managed tape environment. DFRMM is an IBM tape management system provided for MVS/DFP Version 3 users as an interim capability to allow migration to system-managed tape and DFSMSrmm.

  Many other vendors′ tape management system products also have exits that support the IBM Automated Tape Library. If you are using such a product, you should contact the relevant vendor and check which release provides this support.

3.2 MVS/ESA and Basic Tape Library Support

In this section we describe the support for an IBM Automated Tape Library if you have MVS/ESA but do not have system-managed tape installed. The supporting software is BTLS.

3.2.1 Overview

BTLS offers support for IBM Automated Tape Librarys in MVS/ESA environments where system-managed tape is not available.

System-managed tape may not be available for one of the following reasons:

- The level of MVS/ESA is not high enough to support DFSMS/MVS (that is, lower than MVS/ESA Version 4.3).
- DFSMS/MVS is installed, but you do not want to implement system-managed tape at present.
- DFSMS/MVS is installed, but you do not want to migrate to HCD at present.
- DFSMS/MVS is installed, but you want to use more scratch pools at a level other than media type. (BTLS supports up to eight scratch pools.)

You must use BTLS for IBM Automated Tape Library support if you do not have system-managed tape implemented even though you may be using SMS to manage disks, to redirect tape data sets to disk (Tape Mount Management), or both. Please note that only system-managed tape provides the complete integrated support to fully manage the IBM Automated Tape Library. Should you choose to migrate to DFSMS/MVS system-managed tape environment from BTLS

environment, please refer to Appendix D “Migration to DFSMS/MVS” in the *Basic Tape Library Support Version 1 Release 1 User's Guide and Reference* manual.

BTLS provides the LIBRARY command for AMS to manage the interface to the Library Manager. There are other modifications to MVS/DFP to support IBM Automated Tape Librarys; for example, Dynamic Device Reconfiguration (DDR) ensures that when a drive is reallocated, the second drive is within the same library.

See Figure 12 for an overview.

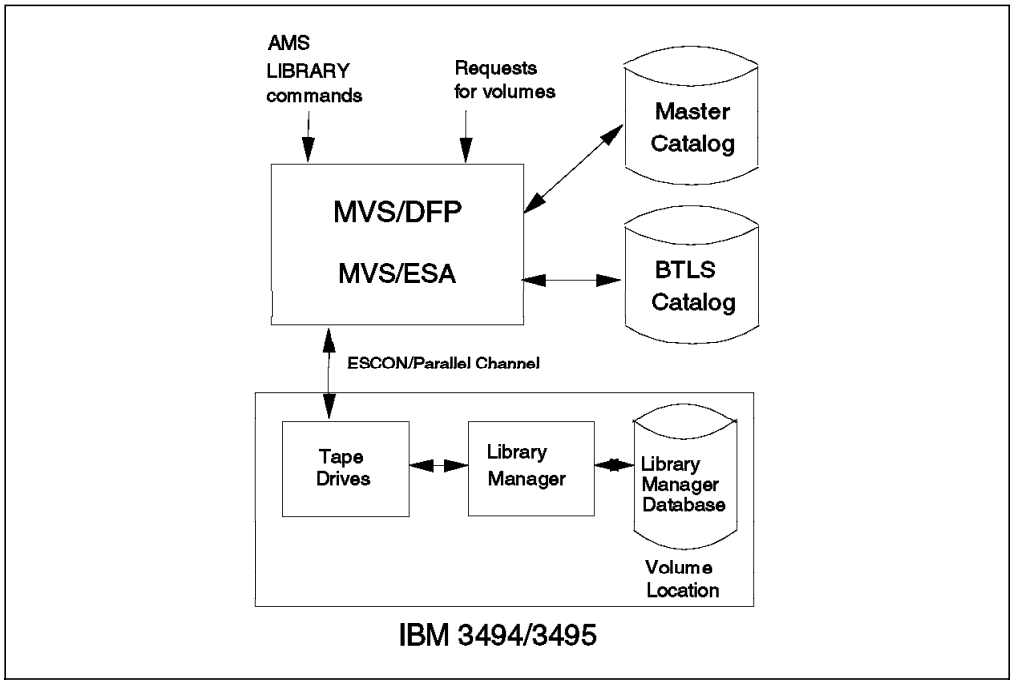

Figure 12. MVS/ESA and Basic Tape Library Support

BTLS is supported in the following environments:

- BTLS for MVS/DFP (JES2 Environments):
  - DFP 3.1.1 + MVS/SP 2.2.3, MVS/SP 3.1.3
  - DFP 3.2.0 + MVS/SP 3.1.3, MVS/ESA 4.1.0, MVS/ESA 4.2.0
  - DFP 3.2.1 + MVS/SP 3.1.3, MVS/ESA 4.1.0, MVS/ESA 4.2.0
  - DFP 3.3.0 + MVS/ESA 4.2.0, MVS/ESA 4.2.2, MVS/ESA 4.3.0, MVS/ESA 5.1.0, MVS/ESA 5.2.0,
  - DFP 3.3.1 + MVS/ESA 4.2.0, MVS/ESA 4.2.2, MVS/ESA 4.3.0, MVS/ESA 5.1.0, MVS/ESA 5.2.0
  - DFP 3.3.2 + MVS/ESA 4.2.0, MVS/ESA 4.2.2, MVS/ESA 4.3.0, MVS/ESA 5.1.0, MVS/ESA 5.2.0
- BTLS for MVS/DFP 5655-057 (JES3 Environments):
  - DFP 3.3.0 + MVS/ESA 4.2.0 with JES3 4.2.1, MVS/ESA 4.2.2 with JES3 4.2.1
  - DFP 3.3.1 (HDP3331) + MVS/ESA 4.2.0 with JES3 4.2.1, MVS/ESA 4.2.2 with JES3 4.2.1
  - DFP 3.3.2 (HDP3332) + MVS/ESA 4.2.0 with JES3 4.2.1, MVS/ESA 4.2.2 with JES3 4.2.1
- BTLS for DFSMS/MVS (JES2 Environments):

- DFSMS 1.1 + MVS/ESA 4.3.0, MVS/ESA 5.1.0, MVS/ESA 5.2.0
- DFSMS 1.2 + MVS/ESA 4.3.0, MVS/ESA 5.1.0, MVS/ESA 5.2.0

- BTLS for DFSMS/MVS (JES3 Environments):

  None. BTLS for DFSMS/MVS is not supported with JES3.

Notes:

- BTLS requires PTF UW02439 when running under MVS/SP Version 2.
- BTLS requires the PTF for APAR OY63009 when running under MVS/SP Version 3 and MVS/ESA Version 4.
- BTLS for MVS/DFP (5655-057) requires the PTF for APAR OW11086 when running under MVS/ESA Version 4.3 or MVS/ESA Version 5.1.
- BTLS for DFSMS/MVS Release 1.1 (5655-056, BTLS FMID JDZ111S) requires the PTF for APAR OW11087 when running under MVS/ESA Version 4.3 or MVS/ESA Version 5.1. This PTF is included in the BTLS for DFSMS/MVS Release 1.2 base product (5655-056, BTLS FMID JDZ11BS).
- New functions introduced with the June 1995 release of BTLS for DFSMS/MVS 1.2 are supported on previous offerings of BTLS when the PTFs for APAR OW12877 (DFSMS/MVS 1.1) or APAR OW12886 (MVS/DFP 3.3) are applied. These PTFs also provide support for MVS/ESA Version 5.2.

3.2.2 Library Manager Interface

Communication with the IBM Automated Tape Library is achieved by use of the AMS LIBRARY command.

The details of commands are in the *Basic Tape Library Support Version 1 Release 1 User's Guide and Reference*.

The functions pertinent to sharing and/or partitioning are these:

- Load the ICL/ACF with volumes from a particular category, or unload the ICL/ACF.
- Associate a particular scratch category of volumes with a particular tape device (so that only that category can be used on that unit), or reset the device to be associated with the installation's default category
- Assign a volume, or a set of volumes, to a particular category, by either direct command or using the IDCLI04 exit.

BTLS provides support to

- Allow communication with the Library Manager
- Support the new AMS LIBRARY command, which is used to perform operations that manage tape volumes
- Ensure that when a device is allocated for a volume mount, both the volume and device reside in the same library (in case of DDR).
- Ensure that reallocation of a device (for example, because of an unusable drive) is made within the same library.

BTLS provides exits that are documented in the *Basic Tape Library Support Version 1 Release 1 User's Guide and Reference*.

3.2.3 Control Data Sets

BTLS uses four types of catalog records. It stores records with volume information in an ICF user catalog; these records are of the form "BTLS.BTLS.VOL.xxxxxx" where xxxxxx is the volume serial number, and they store the name of the library in which the volume resides. The other three catalog records (whose names start with SYS1) are stored in the master catalog. Two concern options used at allocation and the third (of the form SYS1.BTLS.LIB.LIBn) stores the unit addresses of the tape devices in the library, LIBn. No information is stored in the BTLS user catalog pertaining to volumes that are outside a library.

3.2.4 Considerations

Here are some considerations pertinent to sharing or partitioning an IBM Automated Tape Library managed by BTLS:

- For additional information about JES3 support of BTLS, refer to 6.1.4, "JES3 Considerations" on page 121 and Washington Systems Center Flash #9525.
- Duplicate external volume serial numbers are now permitted: The new library option EXPDT9800 allows a duplicate of a BTLS library volume to be mounted on a drive outside the library. This allows you to allocate a drive outside the library for a volume serial that is defined as a library volume. When this option is used, and a JCL DD statement includes EXPDT=98000, BTLS will neither validate nor interfere with the allocation.
- Internal and external volume serial numbers must match. BTLS does not check that there is an internal label on the volume so nonlabeled (NL) tapes and bypass label processing (BLP) are supported. The IBM Automated Tape Library requires every volume to have an external volume serial number that is unique to that library. However, because all volume records are stored in the BTLS catalog, each volume serial number within the system must be unique.
- One BTLS system supports up to eight libraries, which must be called LIBn, where n is 1 to 8.
- There is no interface to allow the automatic update of BTLS records during the housekeeping functions of DFRMM or DFSMSrmm. Therefore you must update the BTLS catalog accordingly using the AMS LIBRARY command.

3.3 VM/ESA Native Support Using DFSMS/VM

In this section we briefly describe the support for the IBM 3494 and 3495 tape libraries in a VM/ESA native environment.

DFSMS/VM Function Level 221 (FL221) is the only means for a VM/ESA system to communicate with an IBM Automated Tape Library. DFSMS/VM also has two other functions, minidisk management and space management; these are not related to the support of IBM Automated Tape Librarys and are not discussed here.

3.3.1 Overview

The removable media services (RMS) function of DFSMS/VM FL221 provides the IBM Automated Tape Library support in VM/ESA environments at Version 1, Release 2 and all higher levels. The RMS support code runs in a service virtual machine called the “removable media services master” (the default name is RMSMASTR). Based on requests from a user’s virtual machine (the mount requestor will typically be your Tape Management system), RMSMASTR provides the following services:

- Mounts a specific volume or a volume from a scratch category to a library tape device.
- Demounts a volume currently mounted on a specific device.
- Queries information about the IBM Automated Tape Library Dataserver resources, including volumes, devices, categories, and overall inventory.
- Associates a specific scratch pool with a library tape device and resets that association.
- Assigns a category to a specific volume.

In practice, when a user wants to use a volume inside the tape library the following sequence of steps (see Figure 13) is required:

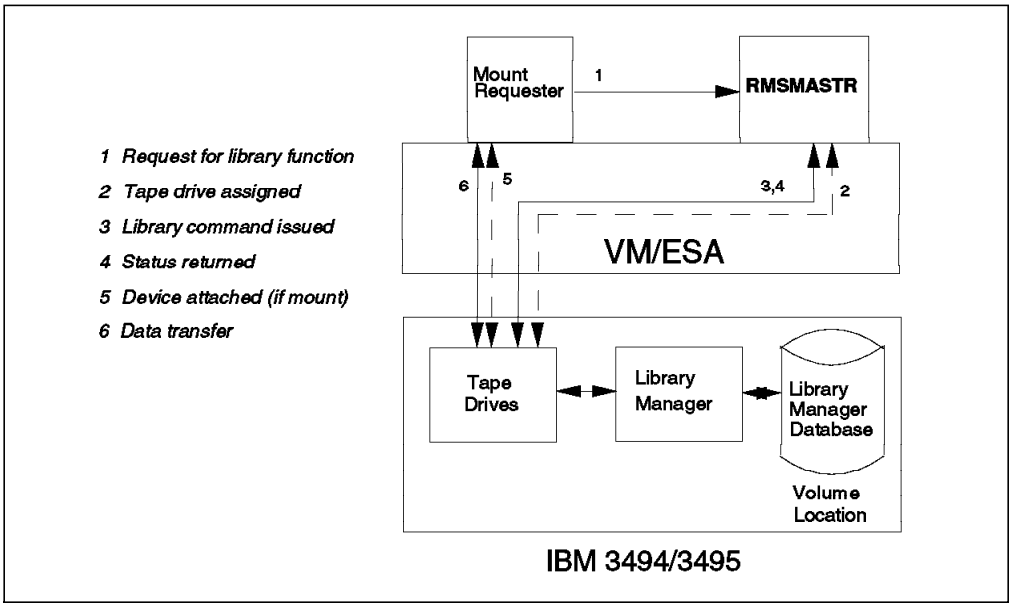

Figure 13. VM/ESA Using DFSMS/VM

1. A user sends a request (such as mount a volume) for a library function to RMSMASTR.
2. RMSMASTR uses the 3490 device specified on the request or attempts to find an available device if one was not specified.

   Notes:

   - If a specific device is requested and the device is not available, the request fails.
   - If a specific device is not requested but an available device cannot be found, the request fails.

In a VM/ESA environment, communication between the host system control program (RMSMASTR) and the Library Manager uses the channel path of the tape drives inside the tape library. For processing the requests to the Library Manager, RMSMASTR requires the real tape device. If a real tape device is not specified, the RMSMASTR chooses a free real address of the tape drive. If no free drive is currently available, the request cannot be processed and must be tried again later.

3. If the specified device is available (or if one is free for a non-device-specific request), the device is attached to RMSMASTR, and the library control command is issued to the Library Manager through the device path.
4. Status is returned to RMSMASTR when the command completes.
5. If a free device was used and no mount request was issued, the device is detached. If it was a mount request, the device is detached from RMSMASTR with the LEAVE option to avoid rewind and unload and is attached to the requester.
6. The requester of the tape library device does its own data transfer. RMSMASTR is not involved.

Access to the IBM Automated Tape Library is provided by an interface that includes both RMS commands (DFSMSRM) for interactive control and Callable Services Library (CSL) routines for program control. You can call RMS CSL routines (FSMRMxxx) from a program that is written in any of these programming languages:

- REXX
- C
- Assembler
- COBOL (IBM COBOL II and OS/VS COBOL Program Products)
- PL/I
- VS FORTRAN
- VS Pascal.

RMS functions do not include tape management system services such as maintaining a removable-media inventory, performing tape-label verification, performing authorization access checks at the volume level, or managing and selecting tape drives. RMS functions are designed to interface with a tape management system. For systems without a tape management system, tape management system-like functions can be added by means of tailoring installation-wide exits.

3.3.2 Library Manager Interface

The interface to the IBM Automated Tape Library is provided by a dedicated service machine called RMSMASTR. This service machine provides removable media services (RMS) to requesting virtual machines. RMS is part of DFSMS/VM FL221.

The requesting virtual machine communicates with RMSMASTR by use of RMS commands and/or the CSL programming interface.

With RMS it is possible to:

- Assign volumes to categories (either one volume or a list of volumes)—DFSMSRM SET VOLCAT.

- Assign a particular category of volumes to a tape drive—DFSMSRM SET DEVCAT. You would usually use the SET DEVCAT to assign a category of scratch volumes to a tape drive equipped with an ICL/ACF. The idea is that scratch performance is increased by getting the scratch tapes preloaded into the ICL/ACF. In a IBM 3494, which has no ICL/ACF, the command still works—the tape drive simply becomes reserved for use by only that category. (By default, at the end of this command the tape drive is not attached to any user; however a command option can attach the tape drive to the command issuer or another user ID.)
- Query the library's inventory—DFSMSRM Query LIBrary (potentially this could be all volumes in a library).
- Assign a volume to a category.
- Perform security checking by means of a supplied exit.

For more information on RMS see the *VM/ESA DFSMS/VM FL221 Removable Media Services User's Guide and Reference*.

3.3.3 Control Data Sets

RMS maintains data about the tape drive configuration in its internal storage and recreates it, if needed, on the bases of rereading the RMCONFIG DATA file.

DFSMS/VM can use RMS bulk processing files to define the category in which to place volumes when they are entered into the IBM Automated Tape Library. There is one bulk processing file for every IBM Automated Tape Library known to the RMS machine. The files can be used for either automatic-insert or on-request bulk processing. An automatic-insert file name is of the form RMBxxxxx DATA, where xxxxx is a number unique to the IBM Automated Tape Library installed. The name is placed in the Shared File System VMSYS:DFSMS.CONTROL directory for access by RMSMASTR. An on-request bulk processing file can have any name and be in any directory accessible to RMSMASTR and the requesting user.

RMS does not keep a record of the volumes in the IBM Automated Tape Library. RMS is provided as an interface to an IBM Automated Tape Library and not for the management of volumes within a library. The Library Manager stores the information for the volumes in the IBM Automated Tape Library. A tape management system provides management of volumes for VM/ESA users, keeping an inventory of volumes and their location (for example, the library name or offsite location in which a volume is stored).

3.3.4 Considerations

Here are some points to consider when you use the IBM Automated Tape Library in a VM/ESA environment.

- DFSMS/VM must be at Function Level 221. VM/ESA must be at Version 1 Release 2 or higher.
- RMS does not check that the internal label of a volume matches the external label.
- An installation-wide exit, FSMRMSHR, provides the facility to check that a request is for a volume or category that the requester is allowed to use. This exit should be used when you are sharing the library between more than one system.

- Automatic insert processing does not immediately occur when a volume is put into the input station because RMSMASTR cannot receive unsolicited interruptions of cartridge insertion without a tape drive attached. RMSMASTR periodically queries the insert category to find out whether there are volumes in it.
  Automatic insert processing occurs when the insert category is not empty and
  - The RMSMASTR service machine is initially started.
  - The RMSMASTR service machine is restarted.
  - A valid MOUNT command is received by the RMSMASTR.
  - A valid SET DEVCAT command is received by the RMSMASTR.

  In the last two cases above, automatic insert processing is totally independent of the actual command issued except that the command must be valid.
  Automatic insert processing itself uses a different tape device address which is selected by the RMSMASTR. If an unused tape device address is not available when insert processing starts, it will not continue. Because insert processing will most likely start before the MOUNT (or SET DEVCAT) finishes with its tape device, another device must be available for this insert processing. If a device is not free, the user can move volumes from the insert category to the category of choice by using the SET VOLCAT BULK command.

  Note: You can disable automatic insert processing simply by not having an automatic-insert file of the name RMBxxxxx DATA. You may want to disable automatic insert processing on a particular VM/ESA system when you share your IBM Automated Tape Library Dataserver with multiple VM/ESA systems.
- It is not possible to create an SMSplex between a VM/ESA system and an MVS/ESA system.
- RMS does not provide tape management functions. (There are a number of software vendor products that provide VM tape management functions.) But it is possible to use the Programmable Operator (PROP) facility of VM to intercept commands to the operator interface originating from a tape management system. PROP can then redirect the commands to RMS for processing.
- Additional information can be found in *Lights Out! Advanced Tape Automation Using VM/ESA*.
- The following provide IBM 3590 software support:
  - VM/ESA Version 2
  - EREP 3.5.0 + PTF
  - DITTO/ESA Release 1
  - ADSM for VM in a future release.

3.4 MVS/ESA As a Guest of VM/ESA

It is possible for the environments described in 3.2, “MVS/ESA and Basic Tape Library Support” on page 41 and 3.1, “MVS/ESA and System-Managed Tape” on page 37 to operate when MVS/ESA is running as a guest of VM/ESA Release 2 or higher. The considerations are the same as when MVS/ESA runs natively without VM/ESA.

In this environment additional software products are not required.

3.5 VSE/ESA As a VM/ESA Guest Using VSE Guest Server

In this section we describe VSE/ESA support of the IBM Automated Tape Library when VSE/ESA is running as a guest of VM/ESA. Information about native VSE/ESA support can be found in 3.6, “VSE/ESA Native Support Using Library Control Device Driver for VSE/ESA” on page 53.

3.5.1 Overview

When a VSE/ESA guest machine uses a tape drive in the tape library, the tape drive must be attached to that machine and the tape volume must be mounted on the drive. Because VSE/ESA as a virtual machine cannot communicate with the Library Manager to request a tape mount, RMSMASTR must attach the tape drive and mount the volume. VSE/ESA cannot use RMSMASTR directly, however, because RMS functions run only in CMS mode. Therefore the VSE/ESA guest typically uses the CMS service machine called the VSE Guest Server (VGS) to communicate with RMSMASTR. Some vendor tape management support scenarios do not use VGS. VGS uses the standard facilities of RMS to interact with the IBM Automated Tape Library.

VSE/ESA communicates with VGS through an application programming interface (API) provided by the LBSERV macro of VSE/ESA. The library control API uses VSE′s cross-partition communication (XPCC) capability to invoke APPC/VM to communicate with VGS.

RMSMASTR handles all requests to the Library Manager. VSE/ESA uses tape drives inside the library in the same way it uses drives outside the library. This operation is the same as in VM/ESA native support. To enable VSE/ESA guest support on VM/ESA, PTFs to both VSE/ESA and VM/ESA provide an API in VSE/ESA and the VGS.

Please note that the VGS is only a way of communicating between RMSMASTR and the VSE/ESA guest machine. There is no direct interface from the VGS to the IBM Automated Tape Library and the tape drive inside the library.

Figure 14 on page 50 shows the VSE/ESA guest support of the IBM Automated Tape Library. Although only a single VSE/ESA guest machine is shown in the figure, you can have multiple VSE/ESA guests sharing one VGS machine.

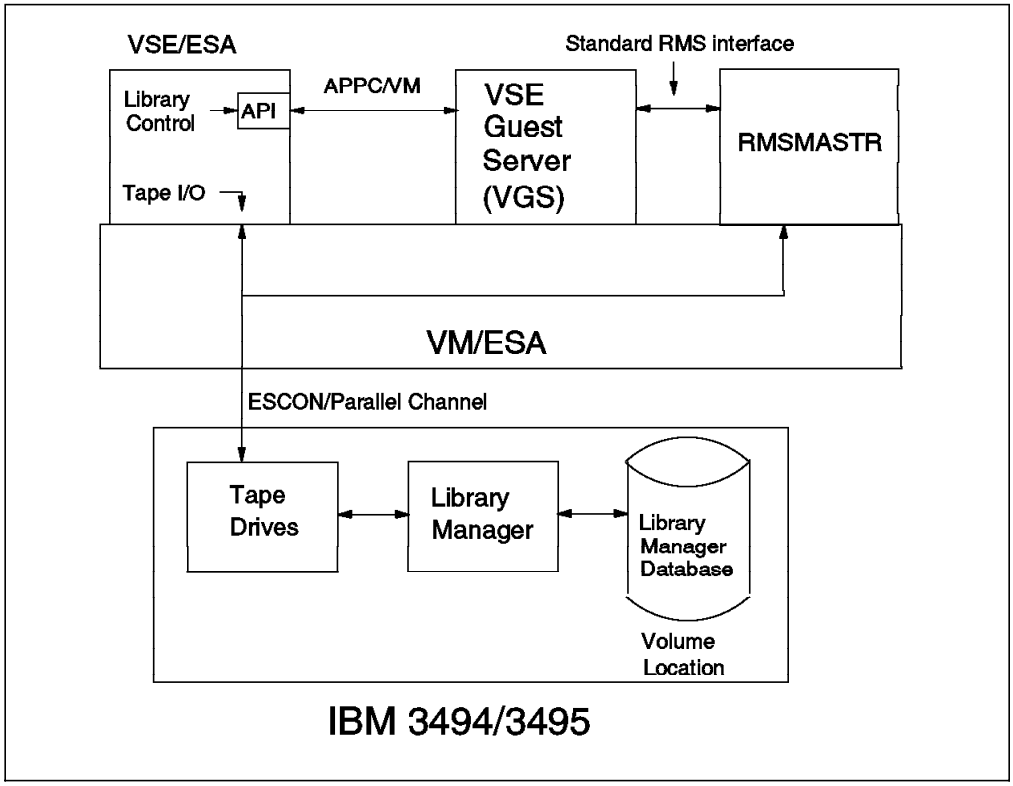

Figure 14. VSE/ESA As a VM/ESA Guest Using VGS

VGS supports a full set of library functions, including inventory functions, which entail reading and updating inventory lists that reside on VSE/ESA as Librarian members. Because the interactions required for processing the inventory functions are elaborate and may be long-running, a secondary VGS service machine for inventory support is required to exploit these functions on the CMS side. In addition, a Librarian Server runs in a VSE/ESA partition. Figure 15 on page 51 shows the flow of an inventory request.

1. The inventory request is sent by means of the LBSERV macro API from the VSE/ESA guest to the VGS.
2. The VGS presents the inventory request to the Inventory Support Server machine.
3. The Inventory Support Server requests the Librarian Server on VSE/ESA to read a Librarian-managed file in the VSE/ESA Librarian files and gets the result.
4. The Inventory Support Server sends the request to RMSMASTR.
5. RMSMASTR sends the request to the Library Manager and gets the result.
6. RMSMASTR returns the result (inventory list for query, result for changing volume category) to the Inventory Support Server.
7. The Inventory Support Server sends the result to the Librarian Server on VSE/ESA, and the Librarian Server writes a new copy of the Librarian file.
8. The Inventory Support Server notifies the VGS that processing is complete.
9. The VGS replies to the LBSERV macro request.

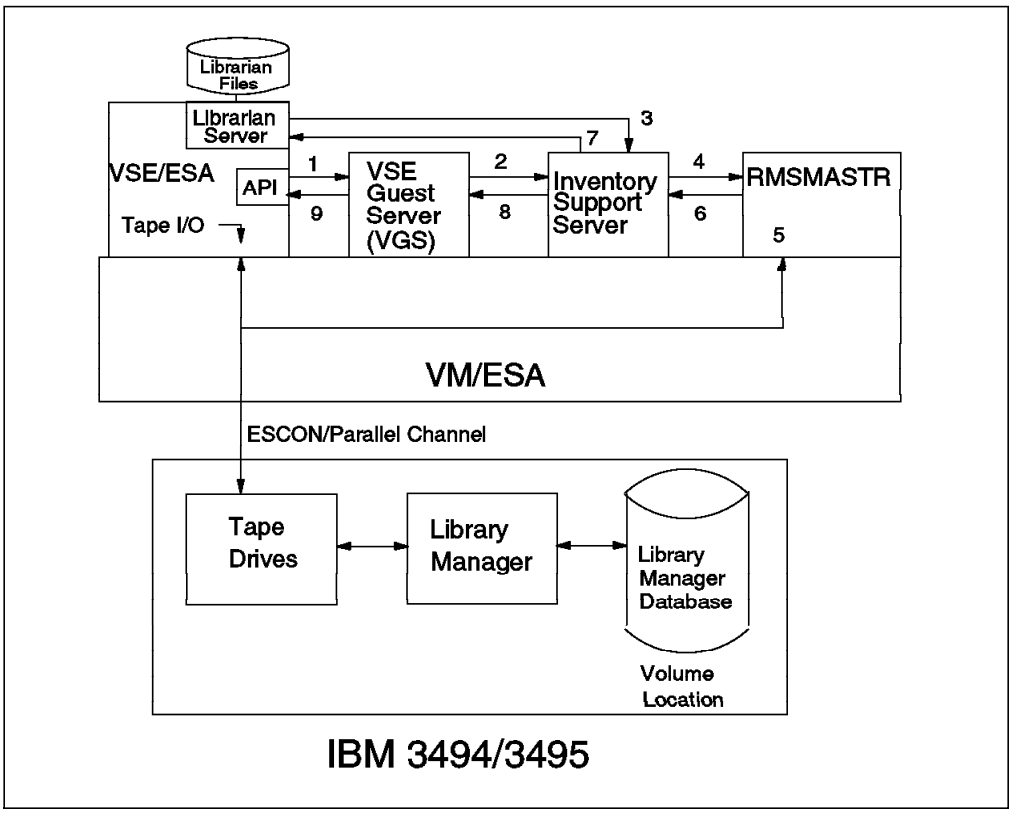

Figure 15. VSE Guest Support: Detail for Inventory Support

3.5.2 Library Manager Interface

The new VSE/ESA LBSERV macro is used to access volumes in an IBM Automated Tape Library. LBSERV can request a mount, query a specific volume′s location, release a drive, cancel a previous request, and eject a volume from the IBM Automated Tape Library. The LBSERV macro is used under program control, and LIBSERV ARs and JCL statements are available external interfaces.

Other functions, such as insert and category management, can be performed through existing DFSMS/VM RMS library control interfaces.

The LBSERV macro accepts requests from VSE application programs as well as LIBSERV Attention Routines (ARs) and JCL statements, and sends them to the VGS, which in turn passes them on to the IBM Automated Tape Library through DFSMS/VM RMS.

The VGS supports the following types of requests for library control:

- Query a volume, checking a single library
- Query a volume, checking all attached libraries
- Query a category count
- Query status of the IBM Automated Tape Library
- Query status of a drive
- Mount a volume
- Mount from category
- Release a drive
- Cancel a mount

- Eject a volume
- Set a volume category
- Query the inventory
- Manage the inventory.

Note: VGS uses the Inventory Support Server as a secondary VGS when processing the above Query/Manage Inventory requests.

An interface for explicit demount is intentionally not provided. The IBM Automated Tape Library automatically queues demount operations at rewind-unload time.

The VGS is given privilege class B in order to perform these functions and to attach and detach tape drives to and from VSE/ESA.

3.5.3 Control Data Sets

The VGS keeps a file (on a CMS minidisk) of in-process and completed work.

The VGS keeps a file, LIBCONFG LIST, that contains the VSE/ESA library names and the corresponding DFSMS/VM library names. This file is optional where only one IBM Automated Tape Library is installed.

The Inventory Support Server (as a secondary VGS) uses a LIBRCMS SRVNAMES file in its 191 minidisk to handle library control for multiple VSE/ESA guests.

The Librarian Server on VSE/ESA uses the VSE/ESA Librarian files for inventory processing such as query and manage.

As with the VM/ESA native environment (see 3.3, “VM/ESA Native Support Using DFSMS/VM” on page 44), the tape management system is responsible for keeping an inventory of volumes in the IBM Automated Tape Library belonging to VSE/ESA.

Note: The VGS customization exit FSMRMVGC is highly important and just as critical to the system as the above control data sets.

3.5.4 Considerations

Here are some points to consider when you use VGS:

- The API support in VSE/ESA is provided by PTFs associated with APAR DY43306 on top of VSE/ESA Version 1.3.5.
- The VGS support in VM/ESA is provided by PTFs associated with APAR VM58436 and VM58787 for DFSMS/VM FL221.
- It is possible to have multiple VSE/ESA guests sharing one VGS machine.
- A VGS machine can manage more than one IBM Automated Tape Library.
- VSE/ESA guests have access to the same set of scratch pools that RMS uses.
- VSE/ESA can cause volumes to be ejected from the library by direct command and can change the category of volumes in the insert category. However, a VSE/ESA guest lacks the capability to be automatically notified that new volumes are being inserted, and there is no IBM-provided mechanism to check whether new volumes are inserted.

- IBM-supplied tape management system products are not available for VSE/ESA.

3.6 VSE/ESA Native Support Using Library Control Device Driver for VSE/ESA

In this section we describe the support for the IBM 3494 provided in a native VSE/ESA environment using the Library Control Device Driver (LCDD) for VSE/ESA.

3.6.1 Overview

Unlike the IBM Automated Tape Library support of VSE/ESA as a VM/ESA guest machine, the VSE/ESA native support requires the LAN attachment feature of the IBM 3494 to communicate with the Library Manager. The token-ring or Ethernet can be used for the LAN. In this environment, the VSE/ESA host uses tape drives inside the tape library in the usual way through ESCON or parallel channels. The VSE/ESA program uses this channel path for normal tape device operations. For library control, the LCDD for VSE/ESA is required. LCDD runs an application program in a VSE/ESA partition and communicates with the Library Manager by using VTAM APPC (LU6.2) through a LAN. The LBSERV macro API is provided in VSE/ESA to communicate with the Library Manager through the LCDD. See Figure 16 on page 54.

There are five interfaces to the LCDD:

- LIBSERV ARs
- LIBSERV JCL statements
- LBSERV API
- MSG operator command
- Batch program LCABAT.

The LCDD interfaces enable the mounting of cartridges, managing the inventory, and retrieving IBM 3494 information. For mount services, specific volume (PRIVATE) mounts and 32 scratch pools (SCRTCH00 to SCRTCH31) are supported. Users can set a default scratch pool by specifying an LCDD control statement.

Automatic insert processing is optional and can be specified by an LCDD control statement with a target category. Users can also dynamically change the automatic insert processing through an MSG operator command. In addition to this, disposition of inserted volumes can be handled by the tape management system product through the LBSERV API, or by LCABAT batch jobs that specify a list of volumes.

Ejecting or changing the category of cartridges can be handled on an individual volume basis or by specifying the file name of a list of volumes to be processed.

Query functions return status information about IBM 3494 tape units and cartridges and the IBM 3494 Library Manager. Library member files of a VSE/ESA Librarian facility are created when inventory lists are requested. The library member files can be used, in turn, as volume lists for other processing requests. An inventory list for the entire IBM 3494 serves as a point in time host backup of the IBM 3494 status of tape processing. This list is potentially useful for recovery purposes because there is no permanent tape inventory data set on VSE/ESA as there is in DFSMS/MVS and BTLS systems.

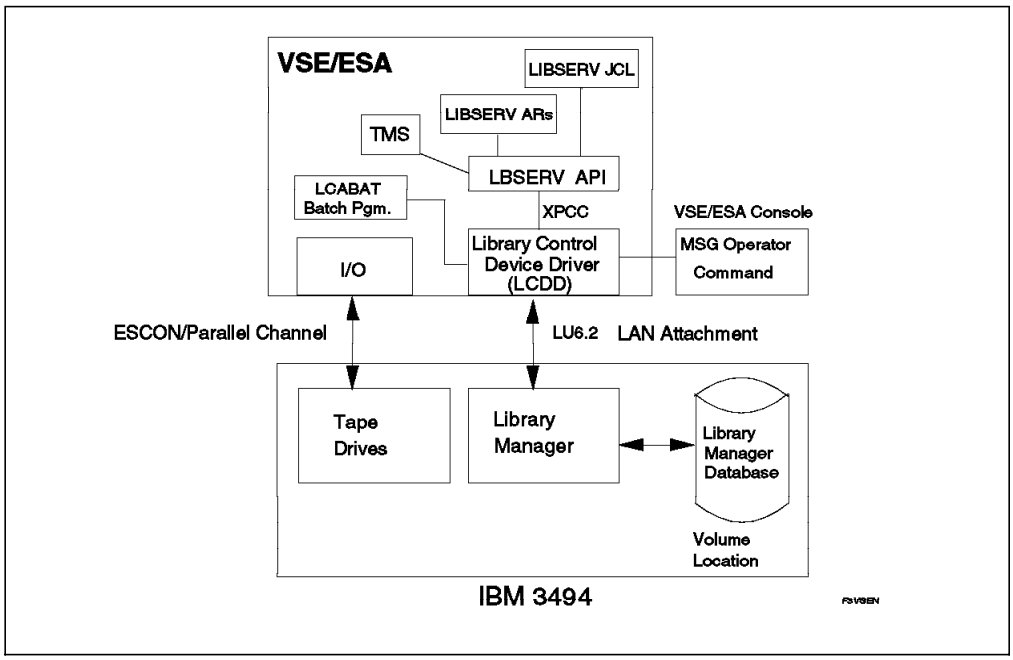

Figure 16. VSE/ESA and LCDD

When jobs running on VSE/ESA are to use the 3494, typically the tape management system product gets control at data set OPEN time and requests the tape mount. Depending on the sophistication of the tape management system support of the 3494, the mount is requested by means of the LBSERV API. A tape management system may help this operation, but IBM does not provide a tape management system for VSE/ESA. Therefore you should ask the software vendors who offer tape management systems for VSE/ESA products.

3.6.2 Library Manager Interface

Communication between the host and the Library Manager is through a different physical path (LAN) from the path used for the data (ESCON or parallel channel).

The LBSERV API handles interaction between the user application and the LCDD.

Commands may be sent to the LCDD using the VSE/ESA operator command, MSG.

A batch interface that uses the LCABAT batch program is provided.

LIBSERV attention routines (ARs) provide an additional interactive interface for library control.

LIBSERV JCL statements allow library control functions in job steps.

For more information, please see *VSE/ESA System Control Statements*.

3.6.3 Control Data Sets

The VSE/ESA Librarian facility is used. Volume lists for the complete IBM 3494 inventory or specified categories can be maintained in VSE/ESA Librarian files. Note that the volume lists are created only by user request and are not updated automatically by the LCDD.

The tape units and library names are held in the LCDD initialization deck.

3.6.4 Considerations

Here are some points to consider when you use the LCDD for VSE/ESA:

- Native VSE/ESA supports the IBM 3494 only.
- VSE/ESA Version 1.3.5 with relevant PTFs is required (please see the "Preventive Service Planning bucket" for such information).
- The LCDD for VSE/ESA is provided by the no-charge feature code 9203 on the IBM 3494. One of the LAN adapter features is required for the IBM 3494—the choice is Ethernet (5220) or token ring (5219).
- It is possible to mount volumes in any of the scratch categories.
- All volumes in a library are potentially accessible by VSE/ESA. In a shared environment the tape management system on the VSE system must provide protection to prevent erroneous access of another system's volumes.
- IBM does not provide a tape management system for VSE/ESA.
- Any other vendor's tape management system must be able to use the LBSERV API of the LCDD.
- VSE/ESA with the LCDD can be run as a guest of VM/ESA. DFSMS/VM is not required in this environment.
- The batch program interface, LCABAT, should not be used to mount a volume.
- The following provide IBM 3590 software support:
  - VSE/ESA Version 2
  - EREP 3.5.0 + PTF
  - ADSM for VSE in a future release
  - DITTO/ESA Release 1.

3.7 AIX/6000 Support

In this section, we describe the support of IBM Automated Tape Library for applications running on a RISC/6000 using AIX/6000. Two environments are discussed: the library device driver environment and the ADSM/6000 application environment. The application environment provides IBM Automated Tape Library management functions in addition to backup/restore and archive/retrieve functions.

3.7.1 Overview

In a RISC/6000 environment there are three types of supported channel attachments for the 3490 tape subsystems: ESCON, parallel, and SCSI. If using parallel or ESCON channels, the RISC/6000 uses the same path for library control commands and data transfer (see Figure 17 on page 56).

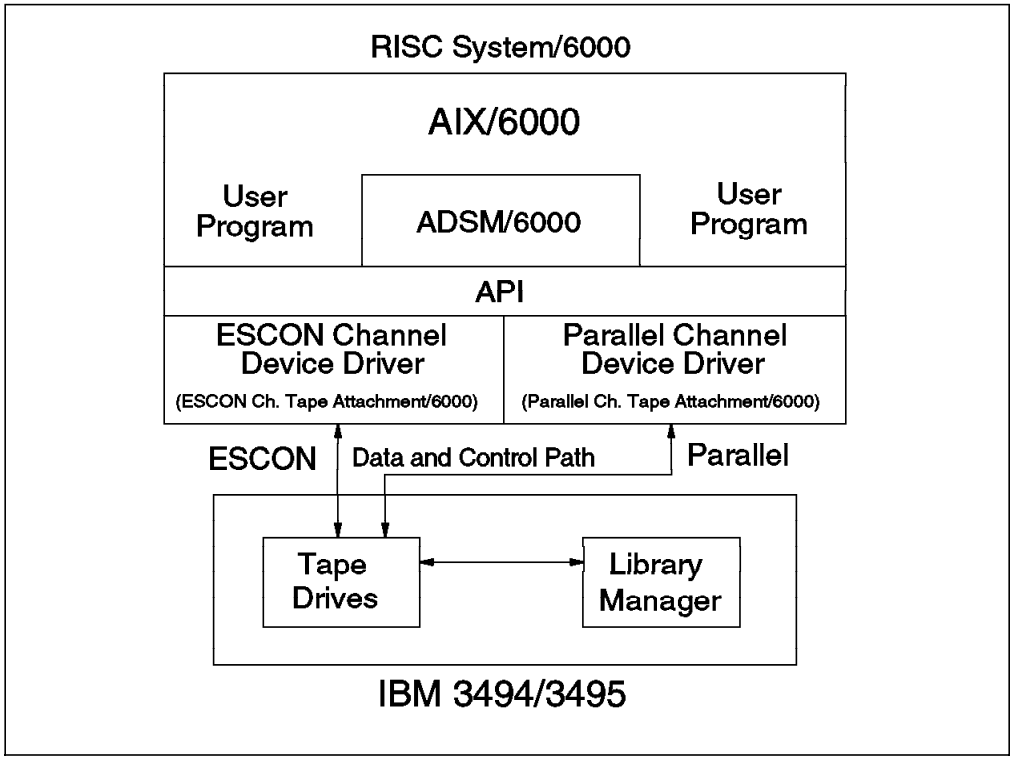

Figure 17. AIX/6000 and IBM 3494/3495 IBM Automated Tape Library: ESCON/Parallel Channel Attachment

If the tape drive is attached using SCSI channels, the data is sent via the SCSI path but the library control commands are sent via an RS-232 or LAN connection to the Library Manager (see Figure 18). The LAN physical link is token-ring or Ethernet.

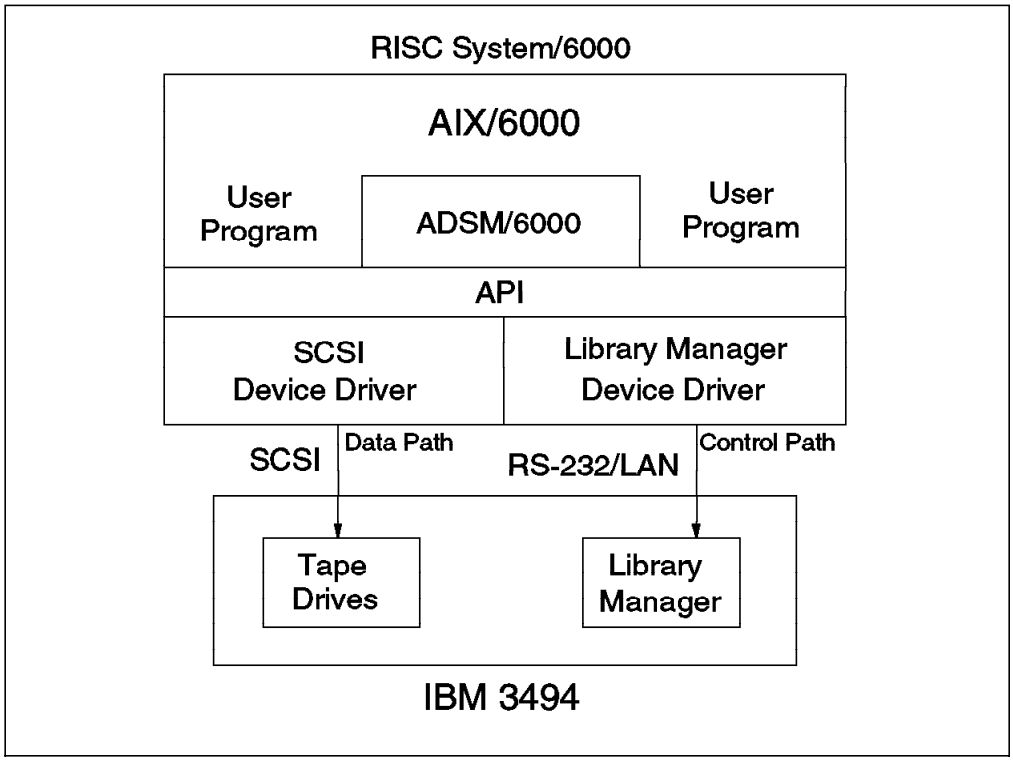

Figure 18. AIX/6000 and IBM 3494 IBM Automated Tape Library: SCSI Attachment

For ESCON attachment, the ESCON Channel Tape Attachment/6000 is required on the RISC/6000 to provide device drivers for both the tape device and Library Manager. These device drivers are available as the feature code 2754 (S/390 ESCON Channel Emulator) of the RISC/6000.

For parallel channel support, the Parallel Channel Tape Attachment/6000 is required on AIX/6000. This program is available as PRPQ 5799-QDA or as feature code 5224 (AIX Parallel Channel Tape Attachment/6000) of the 3494.

In the case of SCSI, feature code 5212 (RS-232 RISC/6000 Host Attachment) of the 3494 is required. This feature contains the AIX Enhanced SCSI device driver (for the data path) and the RS-232/LAN device drivers (for the library manager command path) in addition to the hardware feature on the 3494.

Although all of the above device drivers differ, the APIs are same.

Communication with the Library Manager is achieved using either the AIX system calls provided or ADSM/6000. RISC/6000s can be networked together to share the IBM Automated Tape Library functions through one machine. This approach could be used, for example, to provide a common backup and restore function. The machines could use basic support or ADSM/6000.

3.7.2 Library Manager Interface

Both the library device driver support and ADSM/6000 communicate with the IBM Automated Tape Library using special device files called Library Manager Control Points (LMCPs). There is one LMCP for every tape drive known to the system.

The library device driver uses *ioctl()* system calls to control the IBM Automated Tape Library. The relevant calls here are:

- Change the category of a specified volume—MTIOCLSVC
- Reserve a category for a specified host—MTIOCLRSC
- Release a category for a specified host—MTIOCLRC.

An easy-to-use AIX command is provided with the tape library device driver to control the tape library, tape drive, and the tape volumes. This command is called by MTLIB.

The full syntax of these and other library device driver commands can be found in the *IBM SCSI Tape Drive and Library Device Drivers Installation and User's Guide* and *AIX Parallel and ESCON Channel Tape Attachment/6000 Version 3 Release 1.0 Installation and User's Guide*.

ADSM/6000 provides various functions to manage the IBM Automated Tape Library. Of most interest here is UPDATE LIBVOLUME, which allows the change of a volume's category (from PRIVATE to SCRATCH or SCRATCH to PRIVATE).

3.7.3 Control Data Sets

The system keeps only the drive and library information when using the IBM Automated Tape Library with the library device driver only.

ADSM/6000 keeps records about its volumes in its own database.

3.7.4 Considerations

Here are some points to consider when you use AIX/6000 with the IBM Automated Tape Library:

- The basic level of support is provided in AIX Version 3 Release 2.0 for AIX/6000. There are various dependencies of software levels and hardware; each situation must be checked individually.
- In an ADSM/6000 environment, Release 2 is required.
- Using the library device driver, it is possible to use as many volume categories as desired. The volume categories can be assigned by specifying a Library Manager number, and not by a generic name such as SCRATCHx. The library device driver is not written to use a particular range of volume categories.
- With ADSM/6000 you explicitly state which volume categories are assigned for it to access in the IBM Automated Tape Library. Once you have done that, it uses two: SCRATCH and PRIVATE. It provides management functions to return volumes to scratch once they are empty of unexpired data.
- In both the library device driver and ADSM/6000 environments, securing the commands is vital to avoid erroneously mounting a volume that belongs to another system.
- The following provide IBM 3590 software support.
  - AIX/6000 3.2.5
  - AIX/6000 4.1.1
  - ADSM for AIX/6000 Version 1.2.1 or later
  - IBM Client Input Output/Sockets (CLIO/S)
  - Remote Tape Application Interface (RTAPI) service offering
  - REELlibrarian Release 4.2
  - NSL UniTree Release 2.1

3.8 OS/400 Support

In this section we describe the support for IBM 3494 from an AS/400 running OS/400 using the Media Library Device Driver (MLDD). This is the basic support to control an IBM 3494 from AS/400. We also describe the additional support offered with Backup Recovery and Media Services/400 (BRMS/400).

MLDD provides the basis of support for the IBM 3494, but it is expected that most AS/400 users with an IBM 3494 will use a product such as BRMS/400. This product uses the MLDD commands to interact with the IBM 3494 and provides tape management functions in addition to backup and recovery functions. We strongly recommend the use of a product such as BRMS/400.

3.8.1 Overview

The AS/400 attaches to a IBM 3494 with one connection for the Library Manager and one or more connections for the tape drives. The Library Manager connection, for routing library control commands, uses a communications line. This connection can be either RS-232 or LAN, the LAN physical link is either token-ring or Ethernet, the protocol on the LAN can be APPC only. The tape drive connection could be a parallel channel or SCSI attachment.

The term for an IBM Automated Tape Library in this environment is a Media Library Device. Thus the basic driver is called the Media Library Device Driver (MLDD).

In this environment it is probable (and desirable) that there will be some sort of tape management system, such as BRMS/400. See Figure 19.

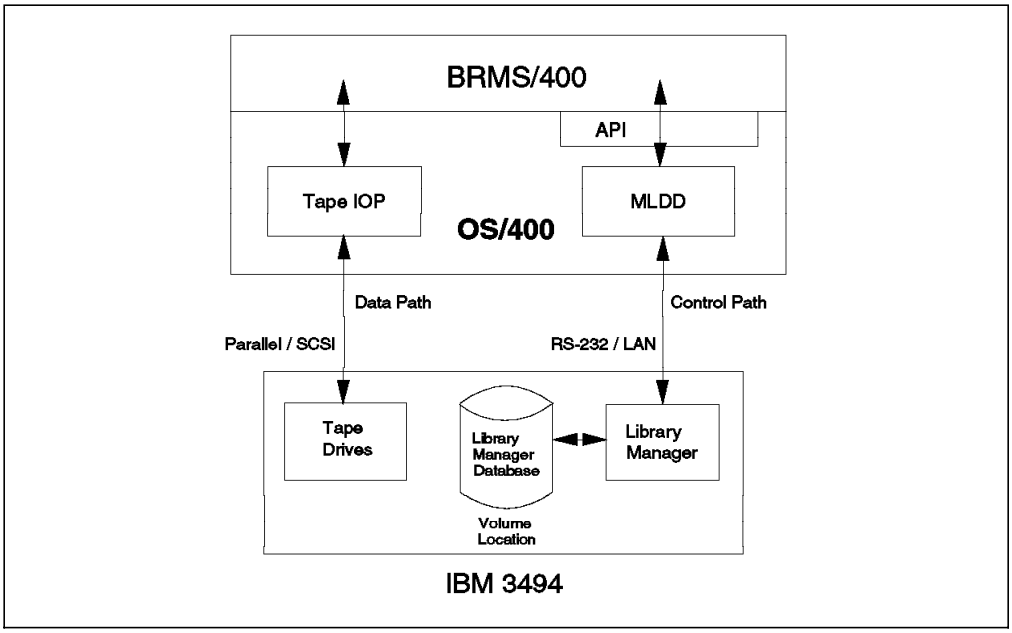

Figure 19. OS/400 Using MLDD and BRMS/400

3.8.2 Library Manager Interface

The physical interface to the Library Manager is an RS-232 or LAN link, which is used to send commands to the Library Manager. Some commands are passed down the data connection to the tape drive, but Library Manager commands are not passed down that way: each AS/400 using the library must be attached to the Library Manager using a separate RS-232 or LAN interface in order to send Library Manager commands.

The OS/400 device driver for the Library Manager is MLDD. MLDD commands are available for interactive use, or in CL (command language) for application or interactive use.

BRMS/400 uses the MLDD commands to interface with the 3494. BRMS/400 uses the WRKMLDBRM command to allow the user to work with functions related to the IBM 3494 and issue MLDD commands without needing to be familiar with the MLDD command set.

3.8.3 Control Data Sets

MLDD stores the information about the IBM 3494s in a library on the AS/400 called QUSRMLD. It does not store information about the volumes held in the library, but it can request of list of volumes from the Library Manager. BRMS/400 also retains a list of volumes, both those within the IBM 3494 and those in an offsite storage location.

If more than one AS/400 is sharing an IBM 3494, these systems can be defined in BRMS/400 as being in a *network group*. The network group enables a common scratch pool to be used by all AS/400s in the group. This means for instance that a request for a scratch volume on system A will be fulfilled by BRMS/400 by issuing the MLDD command to mount a volume. As BRMS/400 knows which volumes are in scratch status, it decides which volume is to be mounted to fulfill the request. For example, system TUC400A could use a special category of volumes called *SHARE400 (which is defined upon installation of MLDD). A second system (for example, TUC400B) could also access this same category. Each system is notified of any changes to the IBM 3494′s contents by another system in the network group. With BRMS/400, the systems share a common media inventory.

3.8.4 Considerations

Here are some points to consider when you use the IBM Automated Tape Library in OS/400 environment:

- There is no IBM 3495 support for AS/400, because you cannot connect anything to a IBM 3495 that requires a library control path to the Library Manager.
- Up to 16 AS/400s can share an IBM 3494. An explanation: The maximum number of data path connections to the IBM 3494 is 16 (two per the eight control unit functions). The maximum number of Library Manager connections is:
  - eight if all are RS-232 connections
  - 256 if all are LAN connections
  - four RS-232 and 256 LAN connections if mixed. This is because the maximum number of RS-232 connections is reduced from eight to four when the Library Manager has a LAN card installed.

  So the limiting number is the 16 data path connections. Using an IBM 3490E tape configuration could get you 16 tape drives, one for each of the attached AS/400s. Using an IBM 3590 tape configuration, you would get only eight tape drives, which would have to be manually switched for the 16 attached AS/400s to share them.
- You can usually daisy-chain multiple processors from a SCSI channel on the IBM 3590-B1A tape drive. AS/400 systems are the exception: an AS/400 cannot be on a SCSI bus with any other processor.
- A single AS/400 system can be connected to multiple tape drive controllers. However, a single AS/400 system cannot be connected twice to the same tape drive controller, as this creates a serial number conflict and results in nonfunctional drives. Such a scenario would be evident during an IPL.
- You must not use the Electronic Communications Adapter on the AS/400 system as a connection to the Library Manager in the IBM 3494. It is reserved for obtaining electronic customer support.
- The number of IBM 3494s that can attach to one AS/400 is determined by the hardware attachment capability of the AS/400 (for example, tape and communications I/O processors).
- OS/400 Version 2 Release 3.1 or later is required to support the IBM 3494. MLDD is shipped with the IBM 3494.
- BRMS/400 is available as a separate product. IBM recommends that you use this or an equivalent product to manage the volumes in an IBM 3494.

- BRMS/400 Version 2 Release 3 or later supports the IBM 3494. It must be installed on all systems in a group of multiple AS/400s in order to be able to synchronize the common media inventory. More information about the use of BRMS/400 can be found in the *Backup Recovery and Media Services/400 Implementation Tips and Techniques*, which includes a chapter on setting up an IBM 3494 with BRMS/400.
- The following provide IBM 3590 software support:
  - OS/400 Version 3 Release 1 with PTF and subsequent releases
  - BRMS/400 Version 3.1 with PTF
  - ADSM for OS/400 Version 1.2 with PTF
  - Report/Data Archive and Retrieval System (R/DARS) Version 1.3 for OS/400.

3.9 Transaction Processing Facility (TPF)

In this section we describe the support for an IBM Automated Tape Library in a native TPF environment.

3.9.1 Overview

The TPF Control Program as well as a number of new and modified TPF E-type programs support the IBM 3494 and 3495 tape libraries.

The support is limited to a command-based interface. There is currently no IBM tape management system for TPF.

3.9.2 Library Manager Interface

The TPF operator's only interface to the IBM Automated Tape Library is a new TPF functional message, ZTPLF. The various functions provided allow the operator to manipulate the tapes in the library as operational procedures require.

The relevant ZTPLF functions are:

Reserve Request or reserve a tape category from the list of general purpose categories. A category number that has no volumes or other hosts associated with it is returned to the operator.

Release Release a previously reserved tape category.

Move Reassign the tape category of a tape volume.

Query Query tape volume, device or category status.

Load Have the IBM Automated Tape Library load (mount) a volume onto a specified device.

Unload Have the IBM Automated Tape Library unload a volume from a specified device or unload all volumes from the device and ICL/ACF and remove the Fill category. Removing the Fill category removes the association of a category with a device.

Fill Keep the tape device (and ICL or ACF if installed) filled with tape volumes of a specific category.

Note: The TPF system handles all subsequent LOAD requests without additional operator intervention, so although continual library requests are being issued, there is only one ZTPLF command.

More information about the use of ZTPLF functions can be found in the *Transaction Processing Facility Operations Guide*.

For more information on TPF in general, please see *Transaction Processing Facility General Information*.

3.9.3 Control Data Sets

The TPF host does not keep a record of the volumes in the IBM Automated Tape Library, nor does it manage the tape volumes within the IBM Automated Tape Library. You can use the above Query command to obtain information about the tape volumes held in the IBM Automated Tape Library.

3.9.4 Considerations

Here are some points to consider when you use the IBM Automated Tape Library in a TPF environment:

- Reserving a tape category does not prevent another host from using that category. It is the users responsibility to monitor the use of reserved categories.
- There is currently no IBM Tape Management System for TPF.
- There is no Automatic Insert Processing provided within TPF.
- To attach the IBM 3494 or 3495 tape library,
  - TPF3.1 must be upgraded using PTF20. The software requires the TPF C feature so this must be present in the system.
  - TPF4.1 will require PUT01 which will be available later. TPF4.1 contains the C support as standard.
- Support for the IBM 3590-A00 attached to an IBM 3495 is provided in TPF via ESCON channel attachment. TPF 4.1 plus PTFs is required

Chapter 4. Multisystem Access

In this chapter, we describe the basic concepts of sharing and partitioning and explain the requirements for using a single or multiple IBM Automated Tape Library in either shared or partitioned mode.

Multihost access can be achieved in two different ways:

- Sharing a single library or multiple libraries by sharing volumes and, in specific environments, drives
- Partitioning a single library or multiple libraries by logically dedicating volumes and drives to a system or a system complex.

We explain both alternatives in Section 4.3, “Partitioning” on page 73 and Section 4.4, “Sharing” on page 74.

Before we explain sharing and partitioning in detail, however, we want you to understand how the different host volume groups are mapped to the unique Library Manager volume categories.

4.1 Mapping Volume Categories to Host Systems

All systems attached to an IBM Automated Tape Library communicate with the same Library Manager and refer to the same Library Manager database. In the Library Manager database, volumes are grouped into volume categories for use by the Library Manager and the attached host systems. (Table 17 on page 177 lists all volume categories, their assignment to a host environment, and their meaning.)

4.1.1 Volume Category Usage

The Library Manager uses volume categories of X′0000′ to X′FFFF′ to group volumes inside an IBM Automated Tape Library. General-purpose categories are used primarily to manage identification and movement of cartridges. Section 4.1.1.1, “Library Manager Exclusive Volume Categories” on page 64 lists these categories in detail.

Different host software platforms use different Library Manager volume categories. Volumes are assigned to these categories during insert processing by the appropriate host system. Sections 4.1.1.2, “DFSMS/MVS” on page 64 through 4.1.1.7, “OS/400” on page 67 review the details of volume category usage for the different platforms.

Drives inside an IBM 3495 can be equipped with ICLs, or ACFs, depending on the tape technology. You can specify the group of scratch volumes to be used on a specific drive by assigning their volume category to the drive. The Library Manager will then arrange for the cartridge accessor to keep loading the ICL/ACF on that drive with the appropriate (scratch) cartridges.

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4.1.1.1 Library Manager Exclusive Volume Categories

The Library Manager uses several volume categories to control the purpose and movement of volumes inside a tape library. Volumes in these categories usually cannot be mounted and processed by a host system. The following Library Manager volume categories are reserved for hardware functions:

X′FF00′ Insert category: a volume has been inserted into the library and has not yet been assigned to a category by the host.

X′FF10′ Convenience eject category: the Library Manager has accepted an EJECT request to the convenience I/O station.

X′FF11′ Bulk eject category: the Library Manager has accepted an EJECT request to the high-capacity I/O station.

X′FFF9′ Service volume category: because of the unique volume serial numbers for service volumes, the Library Manager has identified a volume as a service volume.

X′FFFA′ Manually ejected category: assigned to this category if the cartridge was not found, but was in the inventory in the Library Manager data base.

X′FFFB′ Purged volume category: used only with the IBM 3494. If, after an inventory update, the IBM 3494 finds that cartridges have been removed from the library since the last update, it places those volumes in a category called “Manually Ejected” (FFFA). The host can upload that category and use this purge volume category to delete the database entries in the Library Manager.

X′FFFC′ Unexpected volume category: Reserved for future use.

X′FFFD′ Cleaner cartridge category for IBM 3590 tape drives: Cartridges are assigned to this category when they are identified as cleaner cartridges by the Library Manager, if they also have the character J at the seventh position on the external label.

X′FFFE′ Cleaner cartridge for IBM 3490/3490E tape drives: Cartridges are assigned to this category when they are identified as cleaner cartridges by the Library Manager.

All other categories between X′FF00′ and X′FFFE′ are reserved categories for use by the Library Manager. Categories between X′0001′ and X′FEFF′ are for general programming use and can be assigned by the hosts.

4.1.1.2 DFSMS/MVS

DFSMS/MVS categorizes its volumes in five different groups.

MEDIA1 Scratch cartridge system tape (CST)

Library Manager volume category: X′0001′

MEDIA2 Scratch enhanced-capacity cartridge system tape (ECCST)

Library Manager volume category: X′0002′

MEDIA3 3590 technology scratch tape

Library Manager volume category: X′0003′

ERROR Scratch volumes for which the software detected an error during processing

Library Manager volume category: X′000E′

PRIVATE Private volumes that contain data or are assigned to a specific user

Library Manager volume category: X′000F′

Each group is mapped to a specific Library Manager volume category.

4.1.1.3 Basic Tape Library Support

If you are managing your IBM Automated Tape Library with BTLS, different Library Manager categories are assigned to the groups of volumes. The volume grouping as listed below is used:

SCRTCH or

SCRTCH1 Default scratch volume category

Library Manager volume category: X′0FFF′

SCRTCH2 to

SCRTCH8 Seven optional scratch volume categories

Library Manager volume category: X′0FF2′ to X′0FF8′

ERROR Error category if a label mismatch is detected during demount

Library Manager volume category: X′F00E′

PRIVATE Private volumes that contain data or are assigned to a specific user

Library Manager volume category: X′FFFF′

BTLS offers a choice of eight different scratch pools that are not related to a specific media type. However, if you are using an IBM 3495, including a combination of IBM 3490 and 3490E tape drives, you should not intermix different media types in a single scratch pool because ECCST can be used only on IBM 3490E drives. Also, if you are planning to migrate from BTLS to DFSMS/MVS and system-managed tape, do not mix media types within a single BTLS scratch pool and use different scratch pools only to differentiate media types (namely, CST and ECCST).

4.1.1.4 DFSMS/VM

DFSMS/VM uses the following volume categories:

SCRTCH0 to

SCRTCHF Volumes residing in 1 of 16 scratch volume categories

Library Manager volume category: X′0080′ to X′008F′

VOLSPECIFIC Private volumes that contain data or are assigned to a specific user

Library Manager volume category: X′FFFF′

4.1.1.5 Library Control Device Driver for VSE/ESA

Within the native VSE support, volumes can be assigned to one of the following volume categories:

SCRTCH00 to

SCRTCH31 Scratch volumes residing in 1 of 32 scratch volume categories

Library Manager volume category: X′00A0′ to X′00BF′

PRIVATE Private volumes that contain data or are assigned to a specific user

Library Manager volume category: X′FFFF′

4.1.1.6 AIX/6000

Within AIX/6000 there are no predefined volume categories. You can use the MTLIB program to reserve or release a specific volume category. Several categories may be reserved for the same host:

Example mtlib -l /dev/lmcp0 -r -#XXXX -hhostid, to reserve, where XXXX is the category to be reserved for the specified hostid.

Example mtlib -l /dev/lmcp0 -R -#XXXX -hhostid, to release

For an overview of mtlib commands, please refer to *AIX Parallel and ESCON Channel Tape Attachment/6000 Version 3 Release 1.0 Installation and User's Guide*, and *IBM SCSI Tape Drive, Medium Changer, and Library Device Drivers Installation and User's Guide*.

However, if you want to access your IBM Automated Tape Library from other platforms, we recommend not using volume categories you know are used by other platforms. For an overview of volume categories please refer to Appendix A, "Library Manager Volume Categories" on page 177.

If you are using ADSM/6000, default categories are automatically assigned to scratch and private volumes. These categories are:

PRIVATECAT 300 (equals X′012C′)

This category is used for both IBM 3490 and 3590 ADSM private volumes.

SCRATCHCAT 301 (equals X′012D′)

This category is used for IBM 3490 ADSM scratch volumes.

(implicit) 302 (equals X′012E′)

This category is used for IBM 3590 ADSM scratch volumes.

These default values may be changed at the installation of the library using the DEFINE LIBRARY command. They cannot be updated once the library is defined.

Example DEFINE LIBRARY library_name LIBT=library_type DEVI=/dev/lmcp0 SCRATCHCAT=xxx PRIVATECAT=yyy

The volume categories specified in the DEFINE LIBRARY command (xxx and yyy) are decimal. Only one scratch volume category for the IBM 3490 can be specified in the DEFINE LIBRARY command. The scratch volume category for IBM 3590 is automatically assigned the category whose number is one number higher than the IBM 3490 scratch volume category.

For authorized categories and use of ADSM commands, please refer to Appendix A, "Library Manager Volume Categories" on page 177 and *ADSTAR Distributed Storage Manager for AIX Administrator's Reference Version 2*.

4.1.1.7 OS/400

OS/400 categorizes its volumes in the following groups:

***SHARE400** Volumes that can be shared by all AS/400 systems attached to the IBM Automated Tape Library

Library Manager volume category X'0100'

***NOSHARE** Volumes that can be mounted only by the owning AS/400 system

Library Manager volume category: X'0101'

userdefined Volumes assigned to dynamically created volume categories in order to group them logically. When using BRMS/400 to manage the 3494, these would typically not be used.

Library Manager volume category: above X'0101'.

4.1.1.8 TPF

Within TPF there are no predefined volume categories. You can use the ZTPLF Reserve function to obtain and reserve a general-purpose volume category from the Library Manager that is not already being used. You can then use the ZTPLF Move function to assign cartridges to that category, or to any other general purpose or host-specific category.

4.1.1.9 Usage Considerations

Currently, the Library Manager does not verify whether a host is authorized to request a specific volume mount or a mount from a category. The host software is responsible for ensuring that only volumes belonging to the host are mounted.

The Library Manager does not control whether a certain host system is allowed to use a specific category. If, for example, a mount request is issued for a specific volume, the library manager does not check whether the requested volume has a category assigned that is used by the requesting host.

Figure 20 on page 68 shows four different mount requests issued by a non-MVS host. All volumes except those with volume serial numbers XX0000 and XX0001 belong to a DFSMS/MVS system. The library accepts all mount requests except the mount request from category X'FFFF'. The library manager considers those volumes private volumes and does not allow nonspecific requests.

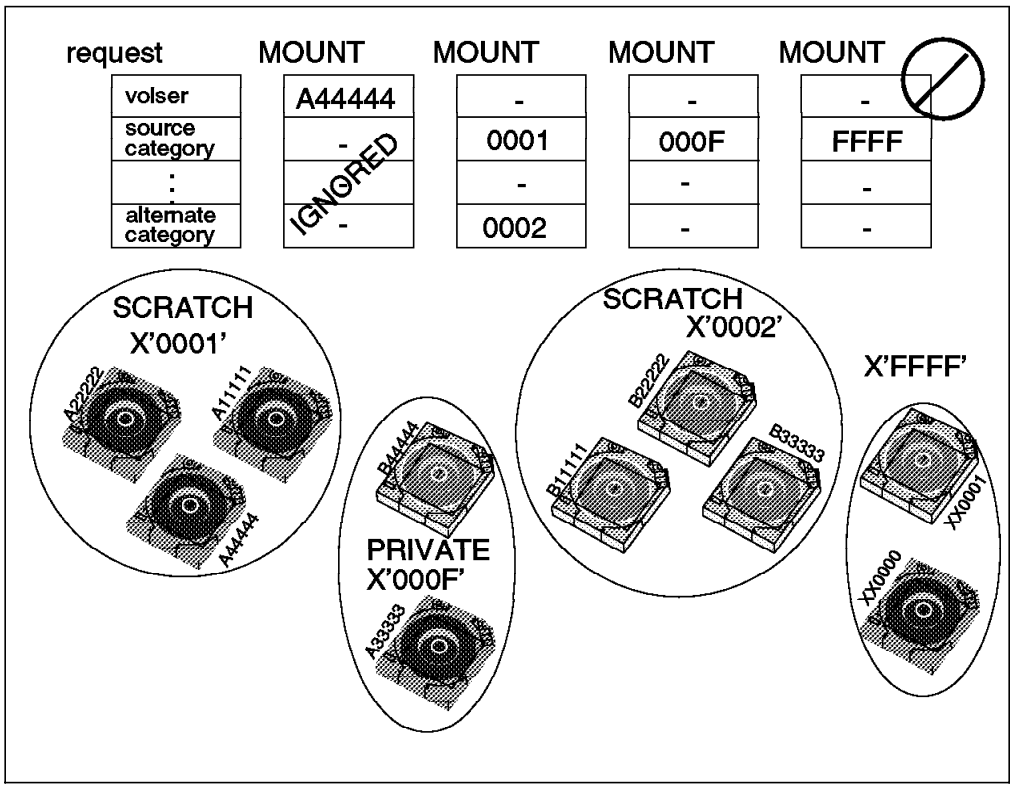

Figure 20. Using Volume Categories

An MVS host would reject the first request, because it is a specific request for a scratch tape. The second request (mount a scratch CST) is correct. MVS does not use the third request because it is a nonspecific request for a private volume.

When a request to change a volume′s category is issued, the library manager only verifies whether the source category of the volume matches, if the volume is currently assigned to the insert category.

4.1.2 Assigning a Volume to a Specific Host

When a new volume is inserted into an IBM Automated Tape Library, or after inventory processing, the Library Manager notifies all attached hosts that there is a volume in the INSERT category. A host system cannot mount or access volumes in this category.

The host processes volumes in the insert category and assigns them to a volume category that allows the volume to be mounted and used on the host system. Once a host assigns a volume in the insert category to another category, subsequent requests from other hosts are ignored. Insert processing is performed as follows:

- **MVS with DFSMS/MVS**

  The Library Control System (LCS), part of the OAM, assigns a status of either PRIVATE or SCRATCH, depending on the definitions in the default data class or the DFSMSrmm control data set. If a status of SCRATCH is assigned, the volume is placed in the MEDIA1, MEDIA2 or MEDIA3 category based on the media type.

During insert processing, the CBRUXENT installation exit is invoked to finally determine whether a volume is ignored, rejected, or inserted. If you use a vendor′s tape management system that provides its own CBRUXENT installation exit routine, you should check that the routine can change the insert processing as described above.

You can change a volume category from SCRATCH to PRIVATE and vice versa through DFSMSrmm, ISMF, or the external macro interface, CBRUXLCS.

- **MVS with BTLS**

  There is no automatic processing in a BTLS environment. The AMS LIBRARY command must be used to assign a status of PRIVATE or to direct the volume into one of eight scratch pools.

- **DFSMS/VM**

  The volumes can be assigned to a scratch or volume-specific category in one of two ways:

  – Manually, by invoking an RMS interface function

  – Automatically, by using automatic bulk processing, which is initiated without human intervention when volumes are detected in the insert category.

  Processing is performed on the basis of an on-request bulk processing file for manual category assignment or an automatic-insert bulk processing file for automatic category assignment. These files list the volume labels or ranges of volume labels, the categories to which the labels are to be assigned, and an optional source category.

- **VSE/ESA Library Control Device Driver**

  As in a DFSMS/VM environment, insert processing in a VSE/ESA environment can be performed manually or automatically. You can use the Set Volume Category request to transfer a specified volume from the insert category to either the PRIVATE or any scratch category.

  On native VSE systems, automatic insert processing can be defined during startup of the VSE library control application together with volume labels and their target categories of PRIVATE or one of the 32 scratch categories. On VSE guest systems, the automatic insert processing is carried out by the VM host.

- **AIX/6000**

  The INSERT (X′FF00′) category is automatically assigned to a newly inserted cartridge. This assignment is maintained until a host command changes the category. Under AIX, you can easily assign a new volume category to a cartridge with the following command :

  Example mtlib -l /dev/lmcp0 -Vvolser -ttarget_category

  For a list of volume categories, please refer to Appendix A, “Library Manager Volume Categories” on page 177.

  For an overview of mtlib command, please refer to *AIX Parallel and ESCON Channel Tape Attachment/6000 Version 3 Release 1.0 Installation and User′s Guide*, and *IBM SCSI Tape Drive, Medium Changer, and Library Device Drivers Installation and User′s Guide*.

If you decided to reserve a specific category for your cartridges to be used by the AIX host, then you have to change the category manually, using the command described above, after the cartridge has been inserted in the library.

If you insert an ADSM cartridge in the IBM Automated Tape Library, the CHECKIN process will ask you to assign to the cartridge the category (SCRATCH or PRIVATE) associated with this volume serial number in the ADSM database. Any mistake in this CHECKIN operation, will be corrected by an AUDIT DB command.

- **OS/400**

  BRMS/400 provides facilities to enroll newly inserted volumes into the BRMS/400 media inventory. Enrolling the volume will change its category from *INSERT to *SHARE400 or *NOSHARE, depending on the share attribute of the new media class that BRMS will assign to the volume. You must use the ADDMLMBRM command to enroll newly inserted volumes; there is no automatic insert processing.

  If you do not use BRMS/400, you need to issue an ADDTAPCTG command for each cartridge to change the category from *INSERT to a usable category. You can also use the work-with-tape-cartridge display (WRKTAPCTG command) to change the category of a cartridge. The relevant MLDD commands are INSMEDMLD for insert, and CHGMEDMLD to change the media. There is no automatic insert processing in the MLDD.

- **TPF**

  There is no automatic insert processing in a TPF environment. The ZTPLF Move function must be used to assign a usable category to cartridges in the insert category.

4.2 Basic Concepts of Partitioning and Sharing

Host access to an IBM Automated Tape Library means access to the Library Manager, drives, and scratch and private volumes. The Library Manager is the central component of an IBM Automated Tape Library and communicates with all attached hosts. Drives and volumes can be either logically partitioned or shared among different hosts.

The term *partitioning* means dividing a physical library into multiple logical libraries. Each logical library contains drives and volumes that other hosts cannot access.

Figure 21 on page 71 shows partitioning of an IBM Automated Tape Library between an MVS and a VM system.

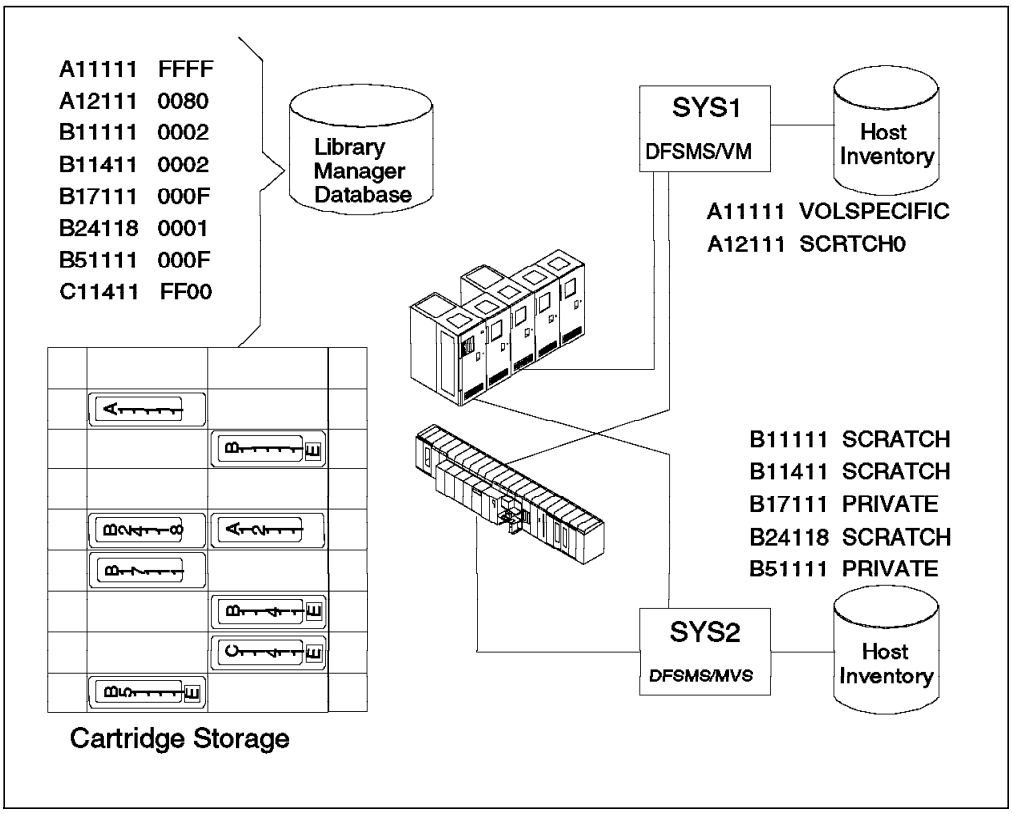

Figure 21. Partitioning an IBM Automated Tape Library Dataserver

The Library Manager database contains one record per volume that resides in the IBM Automated Tape Library. The information listed in Figure 21 is not the complete information contained in the Library Manager database. We show only volume serial number and volume category. The host inventories contain only those volume serial numbers that belong to the volume categories that each host uses.

Notice volume C11411, which resides in the insert category. Because it does not belong to the volume serial numbers used by one of the hosts, it has not yet been processed by a host. At a later time, one of the host systems must assign the volume C11411 to a volume category that allows the volume to be used on the host system.

The term *sharing* refers to different hosts accessing a common set of volumes and, potentially, drives.

Figure 22 on page 72 shows the sharing of an IBM Automated Tape Library between two MVS systems.

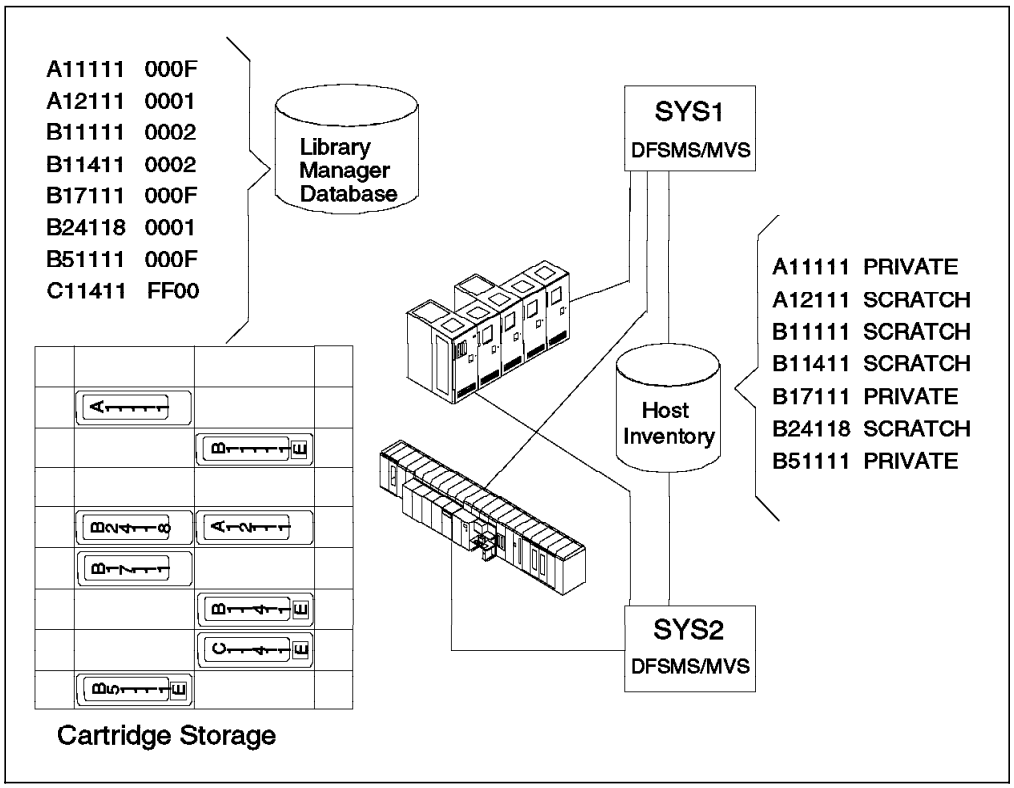

Figure 22. Sharing an IBM Automated Tape Library Dataserver

The two MVS systems share an IBM Automated Tape Library by means of a shared host inventory. Both systems have access to the same set of information and volumes. Volume C11411 is still in the insert category because it has not yet been processed by any attached system.

4.2.1 Drives

The IBM 3490, 3490E, and 3590 tape drives included in the IBM 3494 and 3495 Tape Libraries are attached to the different hosts just like other nonlibrary tape drives.

Because only one host system at a time can use a drive, the drive needs to be dedicated to that host during processing. Sharing of drives can be seen as the dynamic assignment of tape drives to different hosts.

4.2.2 Tape Data Sets

Data can be written on tapes using different tape labels and different data formats. DFSMS/MVS, for example, supports IBM standard labels and ANSI standard labels. Nonlabeled (NL) tapes and bypass label processing (BLP) are now supported for both input and output processing.

Note: Output processing of NL and BLP is not supported in the IBM 3495 M10 Manual Tape Library Dataserver for reasons of data integrity.

The requirements to support NL and BLP do not apply in an AIX/6000 environment. DFSMS/MVS usually uses EBCDIC code when writing data onto tape, whereas AIX/6000 usually writes ASCII, or binary data, or a mixture of both.

To read data written onto tape by another system, both systems need to be able to process the appropriate volume labels and data format.

4.2.3 Scratch Volume Pools

Hosts of different platforms use a different number of scratch pools assigned to different Library Manager categories. Therefore, sharing of scratch pools can be achieved only within a single platform having identical information in the host control data sets or by dedicating scratch pools to a certain system.

4.2.4 Private Volumes

Sharing of private volumes basically depends on whether you can:

- Process the internal tape labels on the sharing hosts
- Read the code in which data is written onto tape
- Ensure that only one host at a time will access a particular cartridge
- Ensure that the other host's control data set is updated in case its status or location is changed by another host system.

We discuss sharing of private volumes in more detail in 4.4, "Sharing" on page 74.

4.3 Partitioning

Dividing one or more libraries into logical libraries is the easiest way to allow different hosts to access them.

Each host or complex owns its own set of drives and volumes, which another system or complex cannot access without manual intervention. Each system knows only about its part of the library. Below we discuss general considerations regarding partitioning.

4.3.1 Planning Considerations

If you plan to partition a library, you need to define some organizational and security procedures.

Because the Library Manager knows about all volumes that exist in its library and because it separates them by category only, the host systems need to determine which volumes belong to whom. These volumes can be identified by defining ranges of volume serial numbers belonging to each system.

In some environments you also need to ensure that only authorized users can issue host commands that control the library operation.

Each partition or logical library can be shared among systems following the recommendations given in section 4.4, "Sharing" on page 74.

4.3.2 Drive Assignment and Cartridge Loading

For drives inside an IBM Automated Tape Library, the assignment is similar to that for stand-alone drives. At a given time, a drive can be online to one host only, to prevent multiple systems from attaching the drive at the same time. In systems that control drive access like JES3 systems and Sysplex shared tape support on MVS/ESA Version 5 Release 2, the tape drives remain online to multiple sharing systems and the drive assignment is dynamically assigned to each system at a time.

In a partitioned library, you can dynamically switch drives only within the same partition.

If you manually reassign a drive to a different system, special attention has to be given to drives equipped with Integrated Cartridge Loaders (ICL) or IBM 3590 Automatic Cartridge Facility devices (ACF). Until you assign a new category to a drive, the Library Manager does not know about it. After you set the drive online to the new system, you need to assign a new volume category to that drive in order to have the Library Manager load the ICL or ACF with the volumes of the appropriate category.

4.3.3 Volume Assignment

The logical partitioning of a physical library means that volumes in different partitions cannot be shared. The host library control mechanisms must ensure that different hosts do not access volumes from other partitions. The Library Manager does not verify whether, for example, a mount requested by a specific host is for a volume that belongs to one of that host's categories.

To avoid inconsistencies in host control data sets, a volume should be defined in only one control data set. Such assignment will prevent mount requests from different hosts for the same volume at a given point in time. Some configurations allow *logical* volume sharing. We explain these configurations in Chapter 5, "Implementation in a DFSMS/MVS Environment" on page 87 through Chapter 10, "Implementation in Other Environments" on page 171.

4.3.4 Volume Transfer

Although you are partitioning your library, you might want to access a private volume for read-only purposes from a system other than the system originally owning the volume. In such cases the volume must be added to the new host's inventory and removed from the other host's inventory. Concurrent access of a volume from more than one system will result in a failure on the last system that requested the mount.

4.3.5 Tape Management Systems

In a partitioned environment, the controlling tape management systems should reflect the same volumes in the library as are contained in the host's inventory. Recording volumes from other partitions could, for example, cause the tape management system to expire them inadvertently and return them to a scratch category that belongs to the system where the tape management system is running.

4.4 Sharing

True sharing of an IBM Automated Tape Library means that the attached hosts have the same access to all volumes in the tape library. You can achieve sharing by sharing the host control data set, tape management system inventory, and usually the catalogs between the attached hosts.

In general, these requirements can be met only in a single-platform environment. Under special circumstances, you can share private volumes. We explain sharing of private volumes in Chapter 5, "Implementation in a DFSMS/MVS Environment" on page 87 through Chapter 10, "Implementation in Other Environments" on page 171.

4.4.1 Planning Considerations

Sharing requires that you answer the following general questions:

- Do all sharing systems share the host inventory?

  If all systems sharing volumes in a library share the host inventory, they have access to the same information, and most of the questions that follow are inapplicable. If they do not share the inventory, you will need to introduce additional rules and procedures.

- Do all systems have access to the catalogs?

  If you are keeping tape data sets based on catalog entries, all systems sharing volumes need to have access to the system′s catalog structure.

- Who is the volume owner?

  When a volume is accessible by different systems, one of those systems is the owner of a volume (usually the system that created the volume). Only the owning system should initiate any status or location changes for a particular volume.

- Who does insert processing?

  When a volume is inserted into a library, all attached hosts are informed about one or more volumes in the insert category. Only one host can do the insert processing for a particular volume. After the volume has been assigned a new category, subsequent requests to assign a category will fail, because the volume′s source category is no longer the insert category. Therefore, it is essential that insert processing follow a common logic for all sharing hosts by assigning identical target categories.

- Do all systems share the tape management system′s control data set?

  If you are not sharing the control data set of your tape management system, or if you are using different tape management systems on different systems, you will need to communicate changes to other systems.

- Who does expiration processing?

  The tape management system usually does expiration processing. You need to ensure that a host does not return another host′s private tapes to scratch. If multiple systems are sharing a tape management system′s inventory, it might be a good idea to have only one host do the housekeeping.

- How are the other hosts informed about status changes of a volume?

  In cases where you are sharing volumes without actually sharing the same host inventory, it is essential to inform other hosts about status changes of a volume. Status or location changes—for example, ejecting a volume from the library—made by one host will usually be reflected only in the Library Manager′s database.

4.4.2 MVS Environments

The sharing of volumes in a system-managed tape environment requires sharing the tape configuration database (TCDB) as well as the active control data set (ACDS), communication data set (COMMDS), and your tape management system′s control data set. In Chapter 5, “Implementation in a DFSMS/MVS Environment” on page 87 we cover the implementation of various alternatives.

The same considerations apply for sharing among multiple BTLS systems. If you want to share your volumes, you need to share the BTLS catalog so that all attached BTLS systems have identical information about volume status.

4.4.2.1 Drive

Drive sharing is the same for library-resident and stand-alone drives.

You can share tape drives in an MVS/JES3 environment.

To share tape drives in an MVS/JES2 environment, use MVS/ESA Version 5 Release 2 switchable tape-device support in a parallel sysplex. This shared tape support requires a coupling facility to share global allocation status and serialize device selections. Tape drives must have the Assign/Unassign hardware feature to be automatically switchable; the IBM 3490, 3490E, and 3590 tape subsystems have this feature, the IBM 3420 tape subsystem does not. Assign/Unassign processing is different for automatically switchable tape devices: a tape drive can be online but not assigned to a system. The drive becomes assigned only when it is allocated.

This MVS/ESA Version 5 Release 2 switchable tape-device support is also applicable to MVS/JES3 installations that do not use JES3 to manage tapes.

To reassign tape drives to another system, the same considerations apply as discussed in 4.3.2, “Drive Assignment and Cartridge Loading” on page 73.

4.4.2.2 Volume Sharing

Full volume sharing can be done in system-managed tape environments where all systems share a common TCDB. In a non-SMS environment, all systems must share the ICF catalog that contains the BTLS inventory.

In an SMS environment, limited volume sharing can be done with other SMSplexes or other platforms. For a detailed discussion, please refer to Chapter 5, “Implementation in a DFSMS/MVS Environment” on page 87.

4.4.2.3 Tape Management Systems

When using DFSMSrmm or another tape management system, the control data sets should contain the same volume information that are in the TCDB. Special DFSMSrmm considerations are discussed in Chapter 5, “Implementation in a DFSMS/MVS Environment” on page 87.

4.4.3 VM Environments

Sharing in a DFSMS/VM environment is provided by means of an installation exit and a control file listing the volumes that are accessible by a single system and by all systems.

DFSMS/VM also allows sharing of tape drives among multiple systems.

4.4.3.1 Drive and Cartridge Loading Considerations

On VM/ESA systems, IBM 3490, 3490E and 3590 drives are dedicated to a processor when the drive is attached to a user by using the ATTACH command rather than when the drive is brought online by using the VARY command. This implementation allows multiple processors to share access to tape drives that are cabled to each processor, by attaching and detaching the drives as required.

By assigning a category to a drive, you can preload cartridges of the assigned scratch pool in the ICL/ACF cartridge loader of that device in the IBM 3495. When the tape drive is detached, the association of device category and tape drive is lost.

4.4.3.2 Volume Sharing

DFSMS/VM allows sharing of volumes among multiple DFSMS/VM systems and sharing of a range of volumes between DFSMS/VM systems and other platforms. For more details, please refer to Chapter 6, “Implementation in a Basic Tape Library Support Environment” on page 113 and *Lights Out! Advanced Tape Automation Using VM/ESA*.

4.4.4 VSE Environments

When VSE/ESA is running as a guest system under VM/ESA you can share tape drives and volumes by means of the DFSMS/VM RMS.

A VSE/ESA guest can share drives with other VSE/ESA guests on the same VM host or on other VM host. No shared DASD is needed. In fact, VSE/ESA guests can also share drives with VM native users. If the natural state of the drives is free, any guest on any physically attached host can ATTACH (whereby ASSIGNment is established).

The VSE/ESA native support (LCDD) allows you to share tape drives and volumes among multiple VSE/ESA systems through a tape management system. A requirement for this drive sharing to work is that the VSE CPUs that share the drives also share at least one DASD volume. When sharing an IBM 3494, you should share your tape management system′s volume catalog among the attached hosts. IBM does not provide a tape management system product for VSE/ESA.

4.4.5 AIX/6000 Environments

It is possible to share drives sequentially with AIX systems. If one AIX machine requests a drive, it issues a RESERVE or ASSIGN I/O command on this drive. If a second system tries to use this drive too, it will issue an error message, and the request will fail. When the first host has finished, it issues a RELEASE or UNASSIGN I/O command and the drive is free again for everyone who needs it.

This is also true with ADSM servers, which use a tape drive dedicatedly only when necessary. The difference is that ADSM uses only drives that are defined to it, regardless of the total number of drives that may be available to AIX.

The ADSM volume inventory database cannot be shared among different ADSM servers, so it is not possible to share tape volumes among ADSM servers.

4.4.6 OS/400 Environments

There is no dynamic sharing of tape drives.

Sharing of volumes in an OS/400 environment is provided by means of the *SHARE400 volume category. Volumes in this category are accessible by all attached AS/400 systems.

4.4.6.1 Drive Considerations

Tape drives residing in an IBM Automated Tape Library can be online to either one or more systems at once. This is defined in the device description for the drive itself. If online to more than one, it is the user′s responsibility to manage drive contention from all systems. This method is not recommended.

Sharing of a drive that is online to only one system is performed by varying on and allocating the drive for exclusive use, then deallocating and varying off the drive when finished. When a drive is varied on and allocated, the other system cannot use it.

4.4.6.2 Volume Sharing

Typically, all AS/400 volumes will belong to the *SHARE400 category. This means that all attached AS/400 systems can use these volumes in the IBM 3494. Volumes can also belong to a user-defined category. The CHGMEDMLD command can be used to logically move the volume to be a member of the new category. This is not commonly used in the AS/400 environment.

4.4.7 TPF Environments

In a TPF environment, you need to assign the tape drives to a single system. There is no dynamic sharing of tape drives.

You can share volumes in TPF environments by using identical volume categories on the TPF systems. There is no host control data set or tape management system. Cross-platform sharing of private volumes is possible because TPF gives you great flexibility in assigning categories to volumes.

4.5 Tape Drive Assignment

As with nonlibrary tape drives, tape drives inside the IBM Automated Tape Library cannot be used from multiple host systems at the same time. Because only one host system at a time can use (read from or write to) a drive, the drive has to be dedicated to that host during processing.

From a hardware point of view, the tape drive is designed to ensure that only one host can use it at one time. The host system must issue special I/O commands to the drive for its specific use. If the tape drive is attached to the host through an ESCON or parallel channel interface, the host system must use the ASSIGN and UNASSIGN channel command words (CCWs). If the tape drive is attached to the host through the SCSI interface, the host system must use the RESERVE and RELEASE SCSI I/O commands. The ASSIGN and RESERVE I/O commands are almost identical, as are the UNASSIGN and RELEASE I/O commands. If a host system issues the ASSIGN or RESERVE I/O command to a tape drive, the tape drive can be used only from the host that issued the ASSIGN or RESERVE I/O command. If other systems try to use the tape drive, their I/O requests are rejected as device busy. To reset the assigned or reserved condition of the tape drive, the UNASSIGN or RELEASE I/O command must be issued from the host that issued the ASSIGN or RESERVE I/O command. If the drive is assigned or reserved from another host system, the ASSIGN or RESERVE I/O command request fails.

Note: Some earlier tape subsystems, such as the IBM 3420 and 3422, do not support the ASSIGN and UNASSIGN I/O commands.

To dedicate a tape drive to a specific host system in a multihost system environment, use the host system commands that control tape drive assignment. In the case of MVS, the user must use the VARY operator command. For AIX, the user can use several commands to control the tape drives: **mkdev**, **rmdev**, **assign**, and **tapeutil**.

In MVS and VM, the VARY ONLINE operator command internally issues the ASSIGN I/O command (CCW) to the tape drive. The VARY OFFLINE operator command internally issues the UNASSIGN CCW to the tape drive. The mainframe systems, MVS, VM, and VSE, use only the ESCON or parallel channel interface. AIX, however, can use the tape drives through both SCSI and ESCON or parallel channel interfaces. The AIX **tapeutil** command is for SCSI-attached tape drives, and the **assign** command is for ESCON- or parallel-channel-attached tape drives. Therefore, the **assign** command issues the ASSIGN and UNASSIGN CCWs, and the **tapeutil** command issues RESERVE and RELEASE SCSI I/O commands.

In the next section, we describe the commands that control tape drive assignment. Please check the jobs running on the host system before changing the status of a tape drive.

4.5.1 MVS/ESA Environments

You can use the following form of the VARY command to place I/O devices online or offline.

For devices managed by JES3, issue a *VARY command instead of the MVS VARY command to change online or offline status. See ″Placing Devices Online or Offline to JES3″ in *MVS/ESA SP V5 JES3 Commands*.

```
V {(device_number(,device_number)...)},{ONLINE}
                                       {OFFLINE}
```

Figure 23. MVS/ESA VARY ON and OFF Operator Commands

device_number A device number is three or four hexadecimal digits, optionally preceded by a slash (/). You can precede the device number with a slash to prevent ambiguity between the device number and a console name.

ONLINE The system is to bring the specified device or ranges of devices online, that is, make the devices or ranges of devices available for users on the system. In a system-managed tape library, if the tape drives within the library were placed offline with both the VARY device and VARY SMS commands, then you must issue both commands to place those devices online.

OFFLINE The system is to take the specified device(s) or range(s) of devices offline, that is, make the device(s) or range(s) of devices unavailable for users. The system takes offline any device that is currently in use only after all the users to which it is allocated terminate.

Examples To make devices 282, 283, and 287 available for system use, enter:

```
V (282,283,287),ONline
```

To take offline any devices in the range 283 through 287 and the range 130 through 135, enter:

V (283-287,130-135),OFFline

Please refer to *MVS/ESA SP V5 System Commands* for a detailed review of all VARY operator command parameters.

4.5.2 VM/ESA Environments

Two commands allow you to vary a tape drive online or offline. The *ATTACH/DETACH* acts at the user (or virtual machine) level, the *VARY ON/OFF* commands acts at the VM control program (CP) level.

4.5.2.1 VARY ON and OFF CP Commands

Use VARY (real device) CP command to do the following:

- Enable or disable a device for the VM control program (CP).
- Enable or disable a device for the user.

```
VARY  ONline   rdev
VARY  OFFline  rdev
```

Figure 24. CP VARY ON or OFF commands

ONline or OFFline enables or disables the logical connection.

rdev is the number of the real device to be varied online or offline.You may specify a list or range of devices. If you specify a range of real device numbers, all valid devices in the range, including the first and last devices you specify, are varied online or offline. The maximum number of devices allowed in a range is 256.

4.5.2.2 ATTACH and DETACH CP Commands

You also can use ATTACH and DETACH (real device) CP commands to do the following:

- Attach real devices to your virtual machine.
- Detach real devices from the virtual machine.

```
ATTACH rdev (TO) userid (AS) vdev
DETACH rdev (FRom) userid (UNLoad|LEave)
```

Figure 25. CP ATTACH and DETACH Commands

rdev is a real device number, a list of real device numbers, or a range of real device numbers to be detached from the indicated user or from the system. On a single command line, you may combine device numbers, lists of device numbers, and ranges of device numbers. Specify a real device number as one to four hexadecimal digits.

vdev is a virtual device number, a list of virtual device numbers, or a range of virtual device numbers to be attached to or detached from the indicated user. On a single command line, you may combine device numbers, lists of device numbers, and ranges of device numbers.

userid identifies the virtual machine to which the device is currently attached or from which it is to be detached. The specified user must be logged on.

UNload detaches the tape device and automatically rewinds and unloads it. UNLOAD is the default unless the tape device was ATTACHed with the NOASSIGN option.

LEave detaches the tape device without rewinding and unloading the tape volume. The tape remains positioned as it was before issuing DETACH.

Remarks Tape devices are automatically UNASSIGNED when you enter the DETACH command unless you have specified the LEAVE option or unless the tape device you are detaching was ATTACHed with the NOASSIGN option.

The ATTACH command automatically issues the ASSIGN CCW to the tape drive unless it was ATTACHed with the NOASSIGN option.

The CP DETACH command will not remove the assignment of a tape drive that is ATTACHed with NOASSIGN, even if the tape is currently assigned by a guest. In other words, when a tape drive is ATTACHed with NOASSIGN, CP DETACH command will NOT change the ASSIGNED/UNASSIGNED status of the drive. It is the responsibility of the guest to issue the ASSIGN CCW when it needs the tape drive and to issue the UNASSIGN CCW when it is finished using the drive.

Please refer to *VM/ESA CP Command and Utility Reference* for more details.

4.5.3 VSE/ESA Environments

The DVCUP command defines a device in the VSE/ESA system and then the ONLINE command is used to make a device available for use on VSE/ESA. The OFFLINE command makes the device unavailable for use by VSE/ESA programs, and then the DVCDN command deletes a device from the VSE/ESA definition.

```
DCVUP   cuu
ONLINE  cuu

OFFLINE cuu
DVCDN   cuu
```

Figure 26. VSE/ESA Commands to Control a Drive

cuu device number

Please refer to *VSE/ESA System Control Statements* for a detailed review of these commands.

It is effective to execute both ONLINE and DVCUP (or OFFLINE and DVCDN) when partitioning library drives.

4.5.4 OS/400 Environments

To change the status of your devices, use the Device Status (DEVICESTS) menu.

To display this menu, select Option 10 (Manage your system, users, and devices) on the Operational Assistant (ASSIST) menu. Then, select Option 20 (Device status tasks). To bring up the Work with Devices display where you can see different kinds of devices at once, use the work-with-configuration-status (WRKCFGSTS) command specifying *BASIC for the assistance level (ASTLVL) parameter and *DEV for the type (CFGTYPE) parameter.

To display and change the status of a device on the Device Status Tasks (DEVICESTS) menu, select the option number that corresponds to the type of device (display, printer, tape, or diskette) whose status you want to see.

On all of the device displays, the device status can be changed with Option 1 (Make available) or Option 2 (Make unavailable) after selecting the corresponding option on the Device Status Tasks menu. The status for all of the devices is shown in the Status column.

Please refer to *AS/400 System Operation V3.1.0* for more details.

4.5.4.1 A Sample Command Language Procedure for Dynamic Tape Sharing

In the case of OS/400 V3R1, it is possible to have some kind of dynamic sharing but only for the benefit of OS/400. The command language procedure in Figure 27 on page 83 allows OS/400 to wait until a drive is available before assigning it.

```
/*************************************************************/
/*                                                           */
/*   PROGRAM NAME : WAITFREE                                 */
/*   LANGUAGE : CLP                                          */
/*   FUNCTION : This program will WAIT FOR THE DEVICE TO BE*/
/*      FREE'D FROM ANOTHER SYSTEM.                          */
/*   PGMS CALLED BY : None.                                  */
/*   PGMS CALLED : NONE.                                     */
/*   PARAMETERS : None.                                      */
/*   INPUTS : Device DESCRIPTION                             */
/*   OUTPUTS : None.                                         */
/*   FILES USED : None.                                      */
/*   DATA AREAS : None.                                      */
/*   MESSAGES USED : None.                                   */
/*   NOTES : None.                                           */
/*   CHANGE ACTIVITY :                                       */
/* FLAG&REASON  DATE    PGMR  COMMENTS                       */
/*************************************************************/
 PGM PARM(&DEV)
             DCL VAR(&DEV) TYPE(*CHAR) LEN(10)
             DCL VAR(&STSCODE) TYPE(*DEC) LEN(5)
 MONMSG CPF0000
/* STRDBG PGM(WAITFREE) */
/*************************************************************/
/*************************************************************/
/*  VARY ON THE TAPE DRIVE                                   */
/*************************************************************/
LOOP:    VRYCFG CFGOBJ(&DEV) CFGTYPE(*DEV) STATUS(*ON)
/* SNDPGMMSG  MSG('VARY SENT') MSGTYPE(*COMP) */
RTVCFGSTS CFGD(&DEV) CFGTYPE(*DEV) STSCDE(&STSCODE)
   DSPPGMVAR  PGMVAR('&STSCODE')
   IF (&STSCODE=30) THEN(DO)
/*SNDPGMMSG MSG('VARY COMPLETED SUCESSFULLY') +        */
/*MSGTYPE(*COMP)                                        */
     ENDDO
   ELSE DO
/*SNDPGMMSG MSG('VARY DID NOT COMPLETE SUCCESSFULLY') +*/
/*MSGTYPE(*COMP)                                       */
    DLYJOB DLY(30)
    GOTO LOOP
    ENDDO
/* ENDDBG */
  ENDPGM
```

Figure 27. A Sample Command Language Procedure for Dynamic Tape Sharing in OS/400

4.5.5 AIX/6000 Environments

The **mkdev** command defines and makes available a previously defined device, specifying it by the device logical name (-l Name flag).

The **rmdev** command unconfigures or both unconfigures and undefines the device specified by the device logical name (the -l Name flag). The default action is to unconfigure the device while retaining its device definition in the Customized Devices object class.

```
mkdev -l Name
rmdev -l Name
```

Figure 28. AIX Commands to Add or Remove a Tape Device

-l Name specifies the logical device, indicated by the Name variable in the Customized Devices object class.

Warning to protect the Configuration database, the **rmdev/mkdev** commands are not interruptible. Stopping these commands before execution is complete could result in a corrupted database.

The **tapeutil** and **assign** commands are used to dedicate (reserve or assign) and undedicate (release or unassign) a tape drive from a AIX system that issued these commands. The **tapeutil** command is used for the tape drive that is attached to the host system through a SCSI interface. The **assign** command is used for the tape drive that is attached to the host system through ESCON or parallel channels.

In these command descriptions, the words “reserve” and “assign” have the same meaning, and “release” means the same as “unassign.” These words come from hardware I/O commands in both SCSI and ESCON or parallel interface.

```
tapeutil -f/dev/ldev reserve     /* for SCSI
assign  -af/dev/ldev             /* for ESCON or Parallel

tapeutil -f/dev/ldev release     /* for SCSI
assign  -uf/dev/ldev             /* for ESCON or Parallel
```

Figure 29. AIX Commands to Dedicate or Release a Tape Drive

reserve Dedicate (reserve) the device to this host. The command uses SCSI Reserve Unit I/O command.

release Undedicate (release) the device from this host. The command uses SCSI Release Unit I/O command.

-a Dedicate (assign) the device to this host. The command uses ASSIGN CCW.

-u Undedicate (unassign) the device from this host. The command uses UNASSIGN CCW.

4.5.6 ADSM/6000 and ADSM/400 Environments

In AIX and OS/400, if the tape drives are only used by ADSM, and not directly by the operating system, then you can use ADSM DEFINE and DELETE commands to change the availability of the drives.

```
DEFine DRive libname drivename DEVIce=devicename
DELete DRive libname drivename
```

Figure 30. Adding or Removing a Tape Device in ADSM

libname specifies the name of the library to which the drive is to be assigned. This parameter is required for all drives, including stand-alone drives. The specified library must have been previously defined using the DEFINE LIBRARY command.

drivename specifies the name assigned to the drive. This parameter is required. The maximum length of this name is 30 characters.

DEVIce=devicename specifies the name of the device that corresponds to the drive. For example, you might specify tap04. This parameter is required.

Examples To define a drive to an ADSM/6000 server

DEFine DRive manlib tapedrive3 DEVIce=/dev/rmt3

To delete a drive from an ADSM/6000 server

DELete DRive manlib tapedrive3

To define a drive to an ADSM/400 server

DEFine DRive manlib tapedrive3 DEVIce=tap04

4.6 Summary

You can always share a tape library or tape libraries by partitioning between different host systems of a single platform or multiple platforms.

You can arrange that all tape volumes be shared between different hosts within a single platform (that is, like operating systems).

Cross-platform access to private volumes is sometimes possible.

Dynamic sharing of tape drives is sometimes possible.

Table 15 summarizes the sharing and partitioning options.

Table 15. Sharing and Partitioning Summary

Platform	DFSMS/MVS	BTLS	DFSMS/VM	VSE/VGS	VSE/LCDD	AIX/6000	OS/400	TPF
DFSMS/MVS	P S D	-	-	-	-	-	-	-
BTLS	P C D	P S D	-	-	-	-	-	-
DFSMS/VM	P C	P C	P S D	-	-	-	-	-
VSE/VGS	P	P C	P C D	P S D	-	-	-	-
VSE/LCDD	P	P C	P C	P	P S D	-	-	-
AIX/6000	P C	P C	P C	P C	P C	P S D	-	-
OS/400	P	P C	P C	P	P C	P C D	P S	-
TPF	P C	P C	P C	P C	P C	P C	P C	P S

Notes:

P indicates partitioning of the IBM Automated Tape Library.

S indicates sharing of all tape volumes.

D indicates dynamic sharing of tape drives.

C indicates cross-platform sharing of private volumes.

When sharing or partitioning an IBM Automated Tape Library, you need to consider the following points for every environment to identify the operational and organizational requirements:

- The host inventory used and the external interfaces. You need this information if you want to transfer volumes from one system to another in a partitioned library.
- The number of scratch pools used in different environments
- The Library Manager categories used in different environments
- The label type restrictions on the different platforms
- The data format (for example, EBCDIC or ASCII) used on different platforms
- The application-dependent data format of the tape data, for example, used by ADSM or DFSMShsm
- How your tape management system communicates with the library-controlling host software regarding inventory updates.

In addition, you must define:

- Which host has to do the insert processing for a particular volume or a group of volumes
- How and by whom volumes should be expired
- Procedures for eject processing
- Procedures to initialize volumes (if you are not in a pure system-managed tape MVS environment)
- Access authorization checking and security requirements.

Chapter 5. Implementation in a DFSMS/MVS Environment

In this chapter, we describe the partitioning and sharing of an IBM Automated Tape Library for an MVS/ESA system that controls the library using DFSMS/MVS. We discuss the basic implementation steps as well as the steps required to share or partition an IBM Automated Tape Library between DFSMS/MVS and other SMSplexes or platforms.

5.1 Basic Implementation Steps

In this section, we summarize the basic software implementation steps to take after you have installed the IBM Automated Tape Library hardware and populated the storage cells with some cartridges. We assume that you have defined your library devices to MVS/ESA. For more details please refer to *DFSMS/MVS V1R3 Object Access Method Planning, Installation and Storage Administration Guide for Tape Libraries*, *IBM 3495 Implementation Primer for MVS*, and *DFSMS/MVS V1R3 DFSMSrmm Implementation and Customization*.

After you have defined the devices through the Hardware Configuration Definition (HCD) dialog, you must prepare the SMS environment. Figure 31 summarizes the implementation steps required to allocate the necessary control data sets and activate the address spaces that communicate with your IBM Automated Tape Library through the Library Manager.

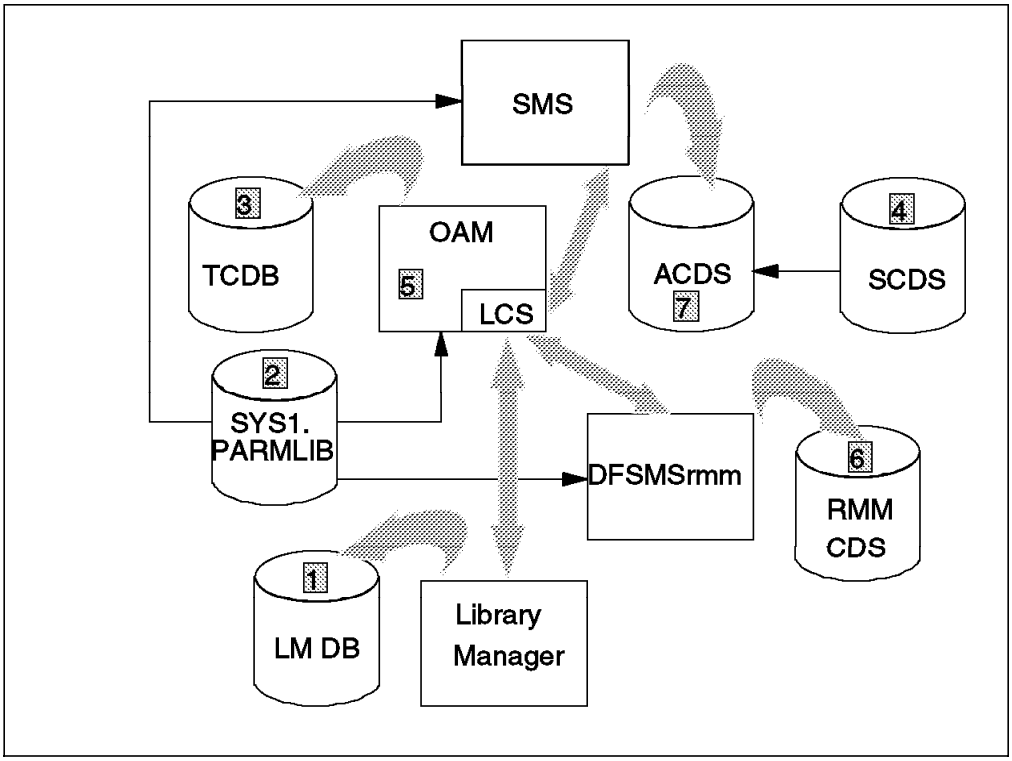

Figure 31. Relationship between Control Data Sets and Address Spaces

Please refer to the *DFSMS/MVS V1R3 Storage Management Library* for more information on implementation and activation of SMS. We cover only those steps necessary to implement system-managed tape.

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The steps are:

1. Inventory the IBM Automated Tape Library.
2. Update SYS1.PARMLIB.
3. Allocate the tape configuration database.
4. Define the library and the DFSMS constructs.
5. Install the installationwide exits.
6. Define volumes to DFSMSrmm.
7. Validate and activate the SMS configuration and start OAM.
8. Initialize JES3.

Step 8 is applicable only to JES3 users.

5.1.1 Inventory IBM Automated Tape Library Dataserver

You need to start an inventory operation from the Library Manager console in order to have all of the cartridge storage cells inspected and all existing volume labels and locations stored in the Library Manager database. This is part of the initial installation process. If later on you insert volumes into the IBM Automated Tape Library, the inventory operation will be done automatically.

During inventory processing, all volumes are placed in the INSERT category. OAM requests information about volumes in the INSERT category as soon as the IBM Automated Tape Library comes online for the first time. Regular insert processing then takes place. If the TCDB does not contain a volume record for a volume processed, the volume record will be created according to information from:

1. DFSMSrmm, provided through the CBRUXENT installation exit
2. The Library Manager for the media type
3. The default data class specified in the active CDS.

5.1.2 Update SYS1.PARMLIB

You need to update the following SYS1.PARMLIB members:

- **SCHEDxx**: Add the OAM initialization module, CBROAM, to the system program properties table.
- **IGDSMSxx**: Add the OAMPROC and OAMTASK optional parameters if you want the OAM address space to start automatically as part of the SMS initialization. If you use a vendor′s tape management system, it may require that the OAM address space be started after the tape-management system initialization. In such a case, do not start the OAM automatically. Please check with the vendor of the tape-management system product.
- **IEFSSNxx**: Add or update the OAM1 entry with the name of the initialization module (CBRINT) executed at IPL.
- **CONSOLxx**: Update the CONSOLxx member referenced by IEASYSxx if you want to receive library messages at a specific console. You must also define this console name during ISMF library definition to SMS.
- **DEVSUPxx**: Update the DEVSUPxx member if you are using 3490 and 3490E devices within the same IBM 3495. The VOLNSNS=YES parameter allows you to relabel volumes for use in 18-track mode after they have been used in

36-track mode. If you use volume partitioning (hard partitioning), you can specify volume category codes in this member. See 5.3.1.1, “Setting Default Volume Categories” on page 99 for detail.

- **COMMNDxx**: Add the VARY SMS,LIBRARY command if you want the IBM Automated Tape Library Dataserver to be brought online automatically after IPL processing.
- **LOADxx**: Update columns 64-71 of the SYSCAT statement high-level qualifier of your TCDB, if you do not want to use the default (SYS1).

  Note: The LOADxx member can reside in SYS1.PARMLIB or SYSn.IPLPARM. When used, SYSn.IPLPARM must reside on the input/output definition file (IODF) volume.

You also need to update PROCLIB by running the CBRAPROC SAMPLIB member.

5.1.3 Allocate Tape Configuration Database

You must allocate the TCDB before you can define an IBM Automated Tape Library to the system. Define one general VOLCAT in a system-managed tape SMSplex. As the volume catalog can be a fairly active data set, make sure that the volume on which the general VOLCAT is allocated is a low-activity volume. Figure 32 shows a sample job to allocate the TCDB.

```
//DEVCAT   JOB ...
//STEP1   EXEC PGM=IDCAMS
//SYSPRINT  DD SYSOUT=*
//SYSIN     DD *
  DEFINE USERCATALOG -
         (NAME(SYS1.VOLCAT.VGENERAL) -
         VOLCATALOG -
         VOLUME(volser)-
         CYLINDERS (1 1))
/*
```

Figure 32. Create a General SYS1.VOLCAT.VGENERAL

Note: Instead of SYS1 you can use a different high-level qualifier. To do so you need to update the LOADxx member in PARMLIB.

Optionally, you can define a specific VOLCAT SYS1.VOLCAT.Vx, where x represents the first character of the volume serial number to be stored in this specific volume catalog.

5.1.4 Define Library and DFSMS Constructs

You define your IBM Automated Tape Library to the system through the ISMF library application. For details on defining your library, please refer to the *DFSMS/MVS V1R3 DFSMSdfp Storage Administration Reference*.

Note: If your IBM Automated Tape Library Dataserver does have an IBM Magstar Virtual Tape Server installed, each physical IBM 3494 or 3495 Tape Library is partitioned into two logical libraries:

- One contains the IBM Magstar Virtual Tape Server subsystem
- One contains all real IBM 3490 and all native IBM 3590 subsytems.

Two library IDs are provided and two libraries must be defined via ISMF library application.

During library define, you specify:

- **Library ID**: the five-character hardware ID associated with the IBM Automated Tape Library
- **Console name**: the optional MVS console name if you have defined one in SYS1.PARMLIB member CONSOLxx
- **Entry default data class**: the name of the data class that you want as the default for tape cartridges entered into the IBM Automated Tape Library being defined
- **Entry default use attribute**: the use attribute for cartridges entered into the library (SCRATCH or PRIVATE)
- **Eject default**: the default action for the TCDB volume record when a tape cartridge is ejected from the library (PURGE or KEEP)
- **Scratch threshold** for MEDIA1, MEDIA2, and MEDIA3: the threshold below which a message is issued to the operator requesting that scratch volumes of the specified media type be entered into the library.
- **Initial online status**: specifies whether the IBM Automated Tape Library will be online, offline, or not connected to the systems or system groups in the SMSplex each time the source control data set (SCDS) is activated.

  Note: When you connect an IBM Automated Tape Library to a system group rather than a system, you lose the ability to vary that library online or offline to the individual system in the group. We strongly recommend that the IBM Automated Tape Library be connected to individual systems only.

In addition, you need to define *data classes* in order to specify the media type, the recording technology, and whether to use hardware compaction when allocating a system-managed tape data set.

You do not have to specify new *storage classes*; you can use existing ones. The storage class is used only to indicate that this is an allocation to a system-managed tape library. There are no new parameters for system-managed tape.

As for system-managed DASD allocations, the *management class* is optional. System-managed tape uses only the expiration attributes and retention limit parameters. If you are using a tape-management system, you should specify a retention limit of NOLIMIT.

You need to define a *tape storage group* and specify which IBM Automated Tape Library belong to that storage group. You also define the storage group status here.

Although a blank storage group is allowed for system-managed tape volumes, we strongly recommend assigning a storage group to private volumes when they are entered into the IBM Automated Tape Library. The blank storage group is always enabled to all attached systems. You can specify the storage group during definition of an existing private volume to DFSMSrmm or during cartridge insert processing.

To direct new tape allocations to an IBM Automated Tape Library, you need to update your *ACS routines*. As for system-managed DASD, new data sets that have a storage class assigned are allocated on system-managed devices.

5.1.5 Install Installationwide Exits

Use of the installationwide exits is optional. However, if you are using a tape management system, you need the exits in order to invoke your tape management system. DFSMSrmm and the tape management systems of some other vendors provide sample exits.

The following sample exit routines are provided in SYS1.SAMPLIB:

- **CBRUXENT**: The cartridge entry installation exit routine is called during cartridge entry processing to approve or disapprove entry of a cartridge into the library and to determine the TCDB volume record contents for each volume entered into the library. If you need to code this exit routine, you can use the SYS1.SAMPLIB member CBRSPUXE as a model.
- **CBRUXCUA**: The change use attribute installation exit routine is called before the TCDB volume record is updated when you issue the CBRXLCS macro or the ISMF line operator ALTER to change a volume′s use attributes. If you need to code this exit routine, you can use the SYS1.PARMLIB member CBRSPUXC as a model.
- **CBRUXEJC**: The cartridge eject installation exit routine is called to approve or disapprove ejecting a cartridge from a library and to determine the TCDB volume disposition and contents for each volume to be ejected. If you need to code this exit routine, you can use the SYS1.SAMPLIB member CBRSPUXJ as a model.
- **CBRUXVNL**: The volume not in library installation exit routine is invoked when there is a request to process tape volumes that are not resident in a library but need to be resident for processing to continue. This exit routine is invoked to give you the opportunity to insert a volume into an IBM Automated Tape Library to prevent job failures. If you need to code this exit routine, you can use the SYS1.SAMPLIB member CBRSPUXV as a model.

For detailed information on the exit routines please refer to the *DFSMS/MVS V1R3 Object Access Method Planning, Installation and Storage Administration Guide for Tape Libraries*.

5.1.6 Define Volumes to DFSMSrmm

The tape volumes residing in an IBM Automated Tape Library must be defined in the DFSMSrmm control data set as well as in the TCDB. If all of your volumes to be entered into the IBM Automated Tape Library are scratch volumes of the same characteristics as specified in the default data class, you do not need to predefine them to DFSMSrmm.

If you are using DFSMSrmm, we recommend that you define your private volumes to DFSMSrmm before entering them into the IBM Automated Tape Library by using the ADDVOLUME command. You can use the CHANGEVOLUME command with the LOCATION parameter to indicate that your existing volumes are to reside inside an IBM Automated Tape Library. However, the location will automatically be updated during insert processing.

If the volumes are to be permanently used inside an IBM Automated Tape Library, you also need to update the home location of the volumes after

inventory processing by using the CHANGEVOLUME command with the HOME parameter specified.

You can also use the CHANGEVOLUME command to specify a storage group name for private volumes. This enables DFSMSrmm to provide the storage group name during cartridge entry processing. Although a *blank* storage group name is valid in system-managed tape environments, you should group your private volumes according to the policies specified in the ACS routines.

For further information please refer to the *DFSMS/MVS V1R3 DFSMSrmm Implementation and Customization Guide*.

5.1.7 Validate and Activate SMS Configuration and Start OAM

You need to activate the SMS configuration before you can start to use your IBM Automated Tape Library. Activating an SCDS validates its contents and copies the contents into the ACDS specified in IGDSMSxx. If the SCDS is not valid, activation fails.

Note: If you are activating another SCDS or reactivating the current SCDS while OAM is running, OAM will restart. During this reinitialization, all IBM Automated Tape Library are set either offline or online according to the attributes defined in the active SCDS.

You need to start the OAM address space in order to allow communication with your IBM Automated Tape Library. Issue the START command from the MVS console. If you have updated the IGDSMSxx member accordingly, OAM will be started automatically during MVS/ESA IPL.

When the IBM Automated Tape Library comes online for the first time, OAM requests information from the library manager about volumes in the insert category and performs insert processing. Volume records in the TCDB will be created or updated.

Vary the IBM Automated Tape Library using MVS operator command, VARY SMS,LIBRARY. If the IBM Automated Tape Library was defined as online during library definition, it is brought online as part of OAM address space initialization.

5.1.8 Initialize JES3

The following setups are required in the JES3 initialization deck:

- Define all devices in the IBM Automated Tape Library through DEVICE statements.
- Set JES3 device names through the SETNAME statement.
- Define which device names are subsets of other device names through the HWSNAME statement.

For more information, please refer to the *IBM 3495 Implementation Primer for MVS*. The information related to JES installation is also valid for IBM 3494 Tape Library with the exception that there are no special ICL considerations.

5.2 Implementing Sharing

Sharing an IBM Automated Tape Library in a system-managed tape environment between several systems or within an SMSplex can be achieved by sharing the TCDB and the inventory of your tape management system. If you are using a single TCDB, you should always use a single DFSMSrmm control data set as well.

5.2.1 Sharing within an SMSplex

In this section, we describe sharing an IBM 3494 or IBM 3495 between multiple systems of a single SMSplex. Figure 33 shows the control data sets and address spaces involved in sharing an IBM Automated Tape Library. All control data sets are accessible by both system SYSA and system SYSB.

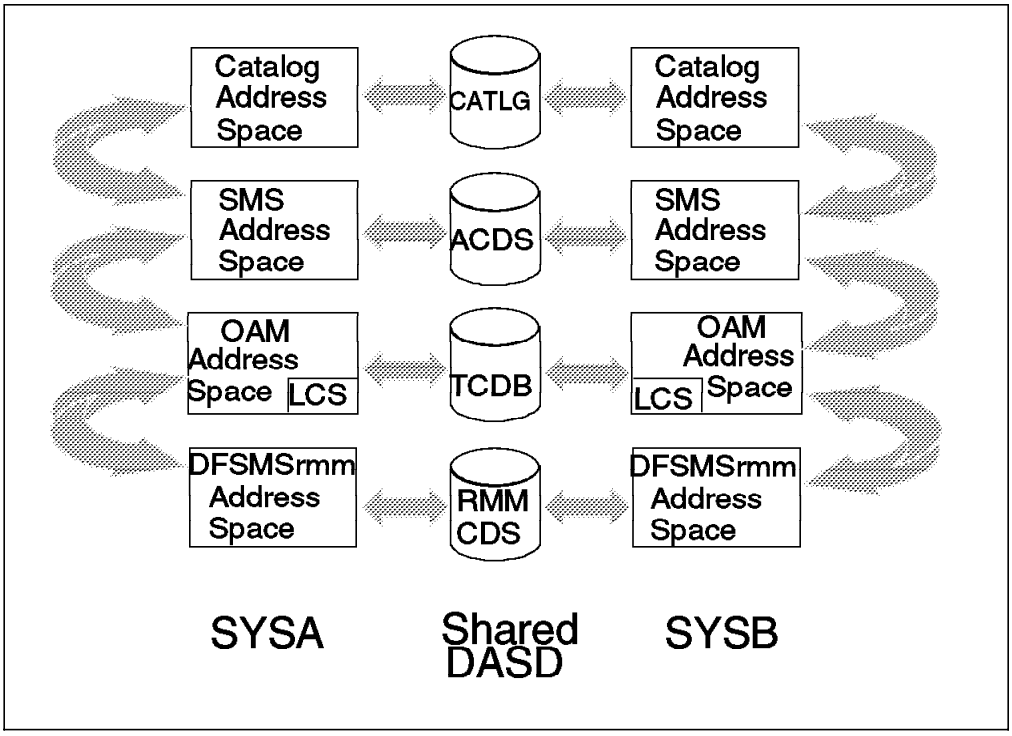

Figure 33. Sharing within an SMSplex

5.2.1.1 Tape Configuration Database

The TCDB must be shared among all systems in the SMSplex that share the IBM Automated Tape Library. After you have allocated the TCDB on one system, if you are not sharing the master catalog as a master catalog on the sharing system, you need to connect it to the other systems in the SMSplex by using AMS command IMPORT CONNECT. Figure 34 on page 94 shows a sample job for importing a general VOLCAT to another system.

```
//IMPVCAT  JOB ....
//STEP1   EXEC PGM=IDCAMS
//SYSPRINT  DD SYSOUT=*
//SYSIN     DD *
  IMPORT CONNECT                        -
         OBJECTS((SYS1.VOLCAT.VGENERAL -
         DEVICETYPE(devtype)           -
         VOLSER(volser)))
/*
```

Figure 34. Import the SYS1.VOLCAT.VGENERAL

Note: You must run the job on all systems that attach to the IBM Automated Tape Library. If you have specific VOLCATs defined, you must IMPORT CONNECT those as well.

5.2.1.2 SMS Configuration

In an SMSplex, you share the SMS configuration in the SCDS. For more information about how to establish sharing of the active ACDS, please refer to the *DFSMS/MVS V1R3: DFSMSdfp Storage Administration Reference*.

You also share the scratch volumes among all systems within the SMSplex. This means that you cannot prevent a scratch volume from being used by another system. You cannot establish private scratch volume pools inside a system-managed automated tape library. DFSMSrmm allows you to request a hardware erase of private tapes before they are returned to scratch and made accessible to other systems.

You can restrict access to private volumes through different control mechanisms:

- RACF TAPEVOL and TAPEDSN profiles
- DFSMSrmm REJECT parameter in EDGRMMxx member
- Denying access for certain systems to specific storage groups.

Figure 35 on page 95 shows the ISMF Storage Group Alter Panel where you can assign a storage group status.

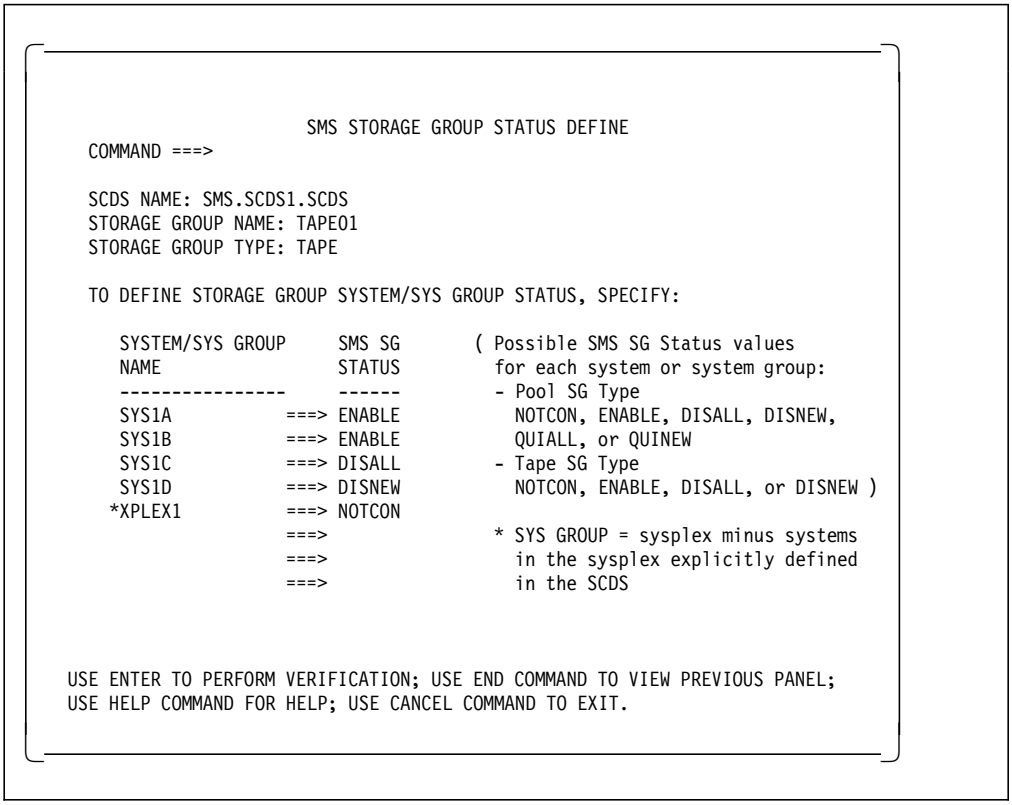

Figure 35. SMS Storage Group Alter Panel

In Figure 35 systems SYS1A and SYS1B are allowed to read and create tape volumes residing in storage group TAPE01. System SYS1C cannot access tape volumes residing in storage group TAPE01 at all. System SYS1D cannot assign volumes to storage group TAPE01 but can access existing volumes in that storage group.

Sysplex XPLEX1 is not connected to the library according to the library definition. If you connect an IBM Automated Tape Library to a system group rather than a single system, an MVS VARY command will affect all systems in the group.

5.2.1.3 Installationwide Exits

Sharing within an SMSplex requires identical installationwide exit routines to be installed on all systems because all systems connected to the IBM Automated Tape Library can perform insert processing. You cannot predict which system will actually process the volumes in the insert category and assign them a category of SCRATCH or PRIVATE.

5.2.1.4 DFSMSrmm Considerations

In an SMSplex sharing an IBM Automated Tape Library, you need to share the DFSMSrmm control data set as well. Because DFSMSrmm is involved every time a tape volume defined to it is accessed, and because DFSMSrmm records all changes, it is necessary to have a single control data set that is accessible by all attached systems and synchronous to the TCDB.

All systems sharing an IBM Automated Tape Library share the same scratch volume pool. To prevent later owners of a tape volume from reading data that has been previously written to the tape, you might want to overwrite existing data before the volume is returned to the common scratch pool. To request the

physical erasure of a tape volume before it is returned to scratch, you can define a security classification for a data set name mask in the SYS1.PARMLIB member EDGRMMxx. Figure 36 on page 96 shows an example of defining a security classification.

```
SECCLS  NUMBER(100)                                    -
        NAME(CONF)                                     -
        DESCRIPTION('CONFIDENTIAL')                    -
        MASK('PAYROLL.**')                             -
        SMF(N)                                         -
        MESSAGE(N)                                     -
        ERASE(Y)
```

Figure 36. Sample SECCLS Command in SYS1.PARMLIB Member EDGRMMxx

The sample SECCLS command causes DFSMSrmm to assign the security level to all data sets that start with the high-level qualifier, PAYROLL. When the tape data has expired, DFSMSrmm does not return the tape to scratch until you have run the DFSMSrmm EDGINERS utility with the ERASE parameter. DFSMSrmm erases the volumes using the hardware security erase feature and reinitializes them so that the correct volume labels are written and the volumes are ready for use.

When sharing the DFSMSrmm control data set as well as the system catalog and the TCDB, only one system needs to execute the DFSMSrmm inventory management program for expiration processing, storage location processing management, and vital record processing. For more details about the options of EDGHSKP, please refer to the *DFSMS/MVS V1R3 DFSMSrmm Implementation and Customization Guide*.

5.2.1.5 Drive Sharing and Cartridge Loading Considerations

When sharing an IBM Automated Tape Library, you must ensure that an individual library-resident tape drive is not allocated concurrently by two systems. A tape drive can be online to only one system in the SMSplex if you do not have JES3, Sysplex shared tape support on MVS/ESA Version 5 Release 2, or equivalent support for the sharing of tape drives.

You can manually reassign tape drives from one system to another. To do so, you need to VARY the drive offline at one system and VARY it online on the other system. Because all systems in the SMSplex use the same scratch volume categories, you do not need to assign a new scratch category to the drive by issuing the LIBRARY SETCL command.

5.2.1.6 Global Resource Serialization

When sharing an IBM Automated Tape Library, you might consider creating a global resource serialization (GRS) ring. The volume catalogs are defined with SHAREOPTIONS(3,4), so the TCDB can be fully shared among two or more systems. To get exclusive control of the catalog's volume, a task in one system issues the RESERVE macro. This is the hardware solution for sharing the TCDB. If multiple systems are sharing an IBM Automated Tape Library, we strongly recommend that you use GRS because the TCDB is a very active data set. GRS can also be used to prevent multiple systems from trying to mount the same volume concurrently.

For detailed information about GRS, see the *MVS/ESA Planning: Global Resource Serialization* and the *IBM 3495 Implementation Primer*.

5.2.1.7 Sharing with Lower Level DFSMS/MVS Systems

When the IBM 3590 tape library support become available, OAM tape library support routines and the LCS will be updated to support the IBM 3590 tape subsystem in the IBM 3494 and 3495 tape libraries:

- Tape configuration database

  To accommodate the new media type and recording technology, the library record and volume record in the tape configuration database (TCDB) have been changed. To share a TCDB with lower-level DFSMS/MVS systems that do not support the IBM 3590 tape drive, toleration PTFs to the lower-level systems are required. The number of scratch volumes and scratch-volume message threshold fields in the new MEDIA3 subparameter have been modified in the tape library record. The new tape-recording technology (128TRACK) and media type (MEDIA3) for the IBM 3590 can be set in the tape volume record.

- LCS external services

  LCS external services provided by the CBRXLCS macro have been changed to support the new media type and recording technology.

  Tape device selection information (TDSI), mapped by the CBRTDSI macro, is used to pass device selection information among system components providing the tape library support. The TDSI now contains the definitions of the new media type (MEDIA3) and recording technology (128TRACK). Source code for CBRTDSI is distributed in SYS1.MACLIB.

5.2.2 Sharing with Other SMSplexes

For sharing between different SMSplexes, the same considerations apply as for sharing within an SMSplex: the TCDB and the tape management control data set have to be shared.

Note: If the SMSplex has more than 16 systems, the ACDS/COMMDS must be limited to DASD volumes capable of supporting 16+ connections (for example DASD volumes attached to a 3990-6 DASD controller). The ACDS/SCDS size will increase.

5.2.2.1 Tape Configuration Database

All information that is stored in the TCDB is the same for each SMSplex:

- The tape library name associated with the hardware library ID must be the same in each SCDS on each SMSplex.
- All tape storage groups defined in each SCDS on each SMSplex must have the same names.
- If an MVS console name is associated with the tape library, that MVS console must be a valid console name on each Sysplex.
- The scratch volume thresholds are identical for each SMSplex.

Changes that are made from one system connected to the library will be valid for each system attached to the IBM Automated Tape Library across SMSplex boundaries.

5.2.2.2 SMS Configuration

When an IBM Automated Tape Library is defined using ISMF, some of the attributes of the tape library are stored in the library record of the TCDB, and other attributes are stored in the library definition in the SCDS. The attributes stored in the SCDS are:

- Entry default data class
- Entry default use attribute
- Eject default volume record disposition
- Online/offline status with respect to each system in the Sysplex.

The parts of the library definition that are stored in the TCDB are identical for each SMSplex. However, the attributes of the IBM Automated Tape Library that are stored in the SCDS can be different between the SMSplexes because each SMSplex has its own SCDS.

5.2.2.3 DFSMSrmm Considerations

If you are following the IBM recommendation to catalog your tape data sets, sharing between multiple SMSplexes requires sharing of the catalog structure as well, in order to enable DFSMSrmm to perform proper inventory management through the EDGHSKP utility.

If you cannot share your catalog structure, we recommend partitioning your IBM Automated Tape Library between the SMSplexes rather than sharing it.

5.2.2.4 Restrictions and Limitations

The TCDB can be shared between the SMSplexes without the use of GRS. However, without the use of GRS, tape-cartridge insert processing will occur simultaneously on each MVS/ESA system to which the IBM Automated Tape Library is connected. This means that a subset of the volumes inserted into the IBM Automated Tape Library will be processed by OAM cartridge insert processing on each system. Because it is not possible to predict which volume is processed on which system, identical installationwide exit routines are required on each system.

The SMS DISPLAY,LIBRARY command will display only information related to the SMSplex where the system from which the command was issued belongs.

The MVS operator on a system of one Sysplex cannot enter a VARY SMS,LIBRARY command to vary the IBM Automated Tape Library online or offline to a system in another Sysplex. To vary the tape library online or offline to a particular system within a given SMSplex, the operator must enter the VARY SMS,LIBRARY command from a system console associated with a system in that Sysplex.

5.3 Partitioning between Multiple SMSplexes

Partitioning in a DFSMS/MVS environment is the logical division of an IBM Automated Tape Library by means of separate TCDBs. You can partition your IBM Automated Tape Library between multiple SMSplexes. Within an SMSplex, you can share your IBM Automated Tape Library. Figure 37 on page 99 shows the control data sets and their association with two different systems in two different SMSplexes that use an IBM Automated Tape Library in partitioned mode.

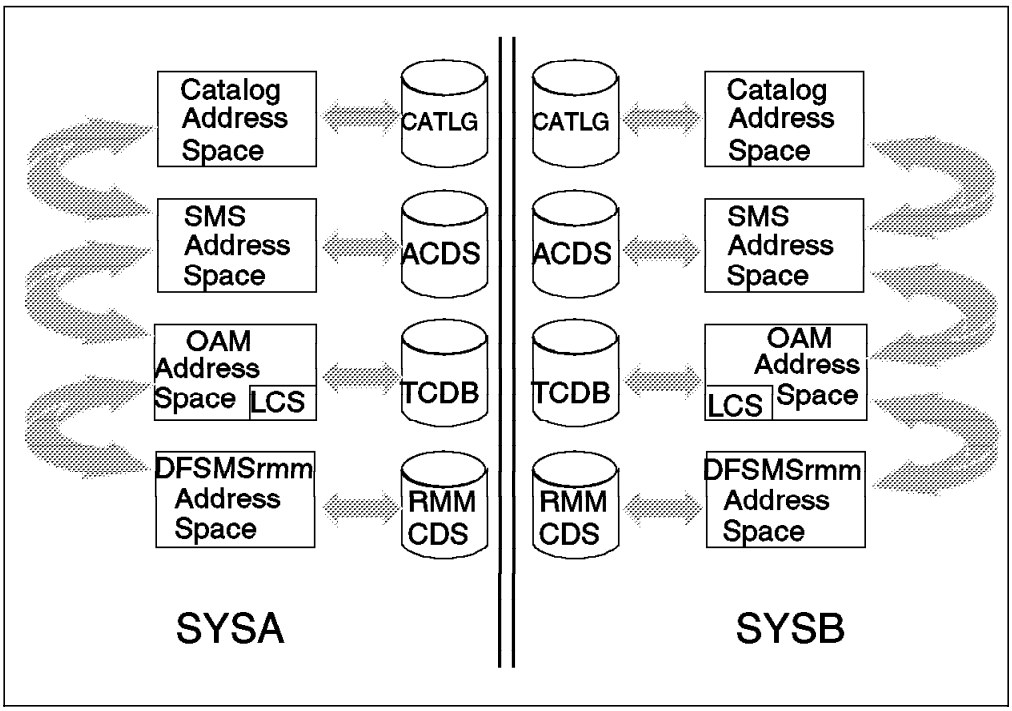

Figure 37. Partitioning between Two SMS Systems

5.3.1 Implementation Considerations

Partitioning an IBM Automated Tape Library between systems that do not belong to the same SMSplex allows you to use the same IBM Automated Tape Library without sharing the same set of control data sets. Partitioning means that both scratch and private volumes are dedicated to one SMSplex and are not shared among the SMSplexes. We call this *hard partitioning*.

5.3.1.1 Setting Default Volume Categories

To do *hard partitioning* (we also call this *volume partitioning*), new parameters have been added in DEVSUPxx member of SYS1.PARMLIB for DFSMS/MVS 1.2 and 1.3. Now you can specify unique volume category codes in the DEVSUPxx SYS1.PARMLIB member on each DFSMS/MVS system. This enhancement eliminates the user modifications described in Section 5.3.1.2, “User Modifications” on page 100. However, the philosophy of *hard partitioning* is exactly same as the user modifications.

The following DEVSUPxx parameters are used to specify volume category codes for library partitioning.

MEDIA1 = xxxx xxxx specify a 2-byte hexadecimal value to be used as the 3490 standard capacity cartridge (CST) scratch volume category code. The default value is 0001.

MEDIA2 = xxxx xxxx specify a 2-byte hexadecimal value to be used as the 3490 enhanced capacity cartridge (ECCST) scratch volume category code. The default value is 0002.

MEDIA3 = xxxx xxxx specify a 2-byte hexadecimal value to be used as the 3590 high performance cartridge tape scratch volume category code. The default value is 0003.

ERROR = xxxx xxxx specify a 2-byte hexadecimal value to be used as error volume category code. The default value is 000E.

PRIVATE = xxxx xxxx specify a 2-byte hexadecimal value to be used as private volume category code. The default value is 000F.

Note: xxxx must be a 4-character hexadecimal value within the range 0010 to FEFF. To avoid conflict volume category with platforms other than MVS system, you should use the range 0010 through 007F. Please refer to Appendix A, “Library Manager Volume Categories” on page 177 to know volume categories that are used by other platforms.

This enhancement is provided by PTF UW90300 (APAR OW20735) for DFSMS 1.2 and PTF UW90348 (APAR OW21351) for DFSMS 1.3. These PTFs are a part of IBM 3590 tape device support SPE.

5.3.1.2 User Modifications

Notice

If you install volume partitioning enhancement described in Section 5.3.1.1, “Setting Default Volume Categories” on page 99, you **do not need to apply** the following user modifications in your DFSMS/MVS systems. But we remain following descriptions to give you good understanding of volume (or hard) partitioning.

Partitioning may use that user modifications (UMODs) be applied on all DFSMS/MVS systems in the SMSplexes that attach to the IBM Automated Tape Library. All systems in one SMSplex have to apply the same UMOD, and all systems in the other SMSplex have to apply a different UMOD.

The UMOD is not against executable code but against constants in a control block in a member of the nucleus, and thus it is not likely to change. The UMOD causes different Library Manager volume categories to be used on the different SMSplexes.

Assume that you have two SMSplexes, PLEX1 and PLEX2. PLEX1 includes systems SYS1A and SYS1B; PLEX2 includes systems SYS2A, SYS2B, and SYS2C. All five systems are attached to the same IBM Automated Tape Library (see Figure 38 on page 101).

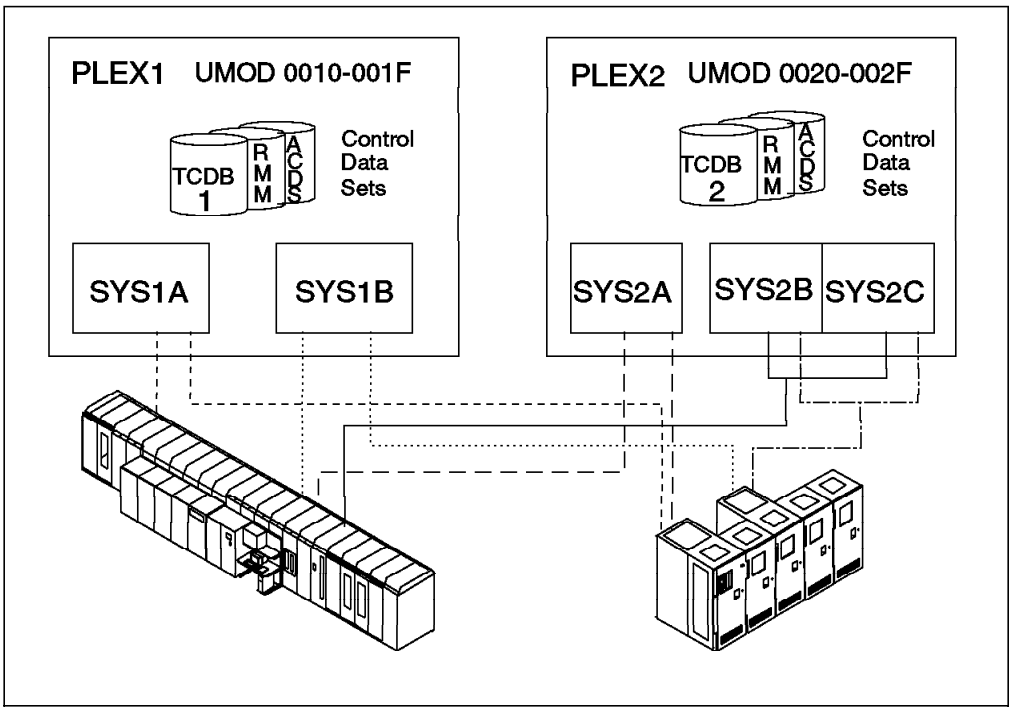

Figure 38. Hard Partitioning Using UMODs

All systems of PLEX1 will use the volume categories of X'0010' to X'001F'; all systems of PLEX2 will use the categories of X'0020' to X'002F'. On all systems of PLEX1 (SYS1A and SYS1B) you need to install the UMOD shown in Figure 39.

Note: The UMOD shown in Figure 39 is for DFSMS/MVS Version 1 Release 1. If you use DFSMS/MVS Version 1 Release 2, see Appendix C, "Sample USERMODs for Tape Library Partitioning," in the *DFSMS/MVS Version 1 Release 2 Object Access Method Planning, Installation, and Storage Administration Guide for Tape Libraries*.

```
++USERMOD(ZAPLEX1)
 /*
    THIS ZAP CHANGES THE 3494 and 3495 CATEGORY ASSIGNMENTS
    FROM X'0001' TO X'0011',X'0002' TO X'0012',ETC.
    EACH TIME AOMCBLKS IS SHIPPED VIA APAR OR PTF THIS UMOD
    WILL REQUIRE AN UPDATE TO THE PRE() AND NEED TO BE REAPPLY'ED
    APPLY TO ALL SYSTEMS IN PLEXA
 */.
++VER(Z038) FMID(JDZ1110)
  PRE(UY87796,UY89640).
++ZAP(AOMCBLKS) DISTLIB(AOSU0).
  NAME IEANUC01 AOMCBLKS
  BASE 0000
  VER 00A0 0001,0002,0003,0004,0005,0006,0007,0008
  REP 00A0 0011,0012,0013,0014,0015,0016,0017,0018
  VER 00B2 000F,000E
  REP 00B2 001F,001E
```

Figure 39. Sample UMOD for All Systems of PLEX1 (for DFSMS/MVS 1.1)

On all systems of PLEX2 (SYS2A, SYS2B, SYS2C) you need to install the UMOD shown in Figure 40 on page 102.

Note: The UMOD shown in Figure 40 on page 102 is for DFSMS/MVS Version 1 Release 1. If you use DFSMS/MVS Version 1 Release 2, see Appendix C, "Sample USERMODs for Tape Library Partitioning," in the *DFSMS/MVS Version 1 Release 2 Object Access Method Planning, Installation, and Storage Administration Guide for Tape Libraries*.

```
++USERMOD(ZAPLEX2)
 /*
    THIS ZAP CHANGES THE 3494 AND 3495 CATEGORY ASSIGNMENTS
    FROM X'0001' TO X'0021',X'0002' TO X'0022',ETC.
    EACH TIME AOMCBLKS IS SHIPPED VIA APAR OR PTF THIS UMOD
    WILL REQUIRE AN UPDATE TO THE PRE() AND NEED TO BE REAPPLY'ED
    APPLY TO ALL SYSTEMS IN PLEXB
 */.
++VER(Z038) FMID(JDZ1110)
  PRE(UY87796,UY89640).
++ZAP(AOMCBLKS) DISTLIB(AOSU0).
  NAME IEANUC01 AOMCBLKS
  BASE 0000
  VER 00A0 0001,0002,0003,0004,0005,0006,0007,0008
  REP 00A0 0021,0022,0023,0024,0025,0026,0027,0028
  VER 00B2 000F,000E
  REP 00B2 002F,002E
```

Figure 40. Sample UMOD for All Systems of PLEX2 (for DFSMS/MVS 1.1)

If you apply a wrong UMOD or no UMOD at all on a system that usually runs with a UMOD, the following exposures exist:

- Without the UMOD applied, a system uses the default categories of X'0001' for MEDIA1 scratch tapes and X'0002' for MEDIA2 scratch tapes. If SYS1A inadvertently removes the UMOD, all scratch allocations of SYS1A would fail, because all scratch volumes of MEDIA1 belong to category X'0011' or category X'0021', and all scratch volumes of MEDIA2 belong to category X'0012' or category X'0022'. There are no volumes in categories X'0001' or X'0002' available in the configuration shown in Figure 38 on page 101.
- If there were a third SMSplex running without the UMOD applied, it would use the default categories. Although volumes are available in the default categories, scratch volume requests of SYS1A will fail because these scratch volumes are not in the TCDB of SYS1A.
- If SYS1A performs insert processing, without the correct UMOD applied, for volumes intended for use of all systems in PLEX1, it will assign the volume to a category that none of the other systems of PLEX1 knows. Therefore the volume cannot be used by the other systems in PLEX1.
- Although requests for private volumes will succeed for either system attached to the IBM Automated Tape Library, a return-to-scratch performed by SYS1A will leave the volumes in a state where they cannot be accessed from either PLEX1 or PLEX2.

To correct a situation where one system has been running without the correct UMOD applied, you need to:

1. Apply the UMOD at the subject system.

2. Move scratch volumes that have been assigned to the wrong scratch category during insert processing. To change a volume′s scratch category, you can use the ISMF Tape Volume application.
3. Move volumes that have been returned to scratch by the system running without the UMOD, to the correct category. This can be performed on either system of the SMSplex.

Private volumes created by either system can be accessed even when the UMOD was not correctly applied, because the TCDB contains the status of PRIVATE rather than the actual Library Manager volume category. Upon return to scratch, private volumes get the correct scratch category assigned.

5.3.1.3 Installationwide Exit Routines

Partitioning an IBM Automated Tape Library requires that part of the volumes belong to one SMSplex and another part to another SMSplex. The cartridge entry exit routine CBRUXENT needs to be identical for every system in a given SMSplex. It also needs to distinguish between the volumes belonging to that SMSplex and volumes belonging to another SMSplex. DFSMSrmm provides this capability through its REJECT parameter. If you are not using DFSMSrmm, you need to code a CBRUXENT exit routine that ignores the volume by setting a return code of 12.

If a mount request for a private volume is issued, the MVS allocation routine and SMS check the TCDB to determine whether a volume resides inside or outside an IBM Automated Tape Library. If the volume record cannot be found in the TCDB, the CBRUXVNL exit routine is invoked to allow the volume to be entered into the library and prevent job failures.

The exit routine can either make no changes and allocate a stand-alone device outside an IBM Automated Tape Library, cancel the request, or allow the volume to be entered into the IBM Automated Tape Library. Entering the volume into the IBM Automated Tape Library will cause regular insert processing to be performed. In a partitioned environment, consider the exit to fail the request for volumes belonging to another SMSplex. If a user ejects the volume and reenters it into the IBM Automated Tape Library, normal insert processing would assign it to the original system. Not changing anything would lead to allocation of a drive outside the IBM Automated Tape Library.

DFSMSrmm provides the exit routines and prevents, by means of its reject parameter, other systems from accessing private volumes belonging to another SMSplex.

5.3.1.4 TCDB Considerations

Each SMSplex uses its unique TCDB in a partitioned environment. We recommend using unique prefixes when defining your general and specific volume catalogs in order to prevent naming conflicts and duplicate data set names if an SMSplex were to be moved, for example. This approach also allows a disaster recovery site to have TCDBs for all SMSplexes.

5.3.2 DFSMSrmm Considerations

The DFSMSrmm control data set is related to the TCDB and therefore should not be shared when partitioning an IBM Automated Tape Library. You are required to use separate DFSMSrmm control data sets when partitioning by means of separate TCDBs for different systems or SMSplexes.

DFSMSrmm provides support for partitioning through its REJECT parameter in SYS1.PARMLIB member EDGRMMxx. For example, if one system uses volumes A00000 to A99999 and the other uses B00000 to B99999, assuming A* is PLEX1 and B* is PLEX2, you define REJECT ANYUSE(B*) to DFSMSrmm on PLEX1 and REJECT ANYUSE(A*) to DFSMSrmm on PLEX2. At cartridge entry time for volume A33333, DFSMSrmm on all systems in PLEX2 sets RC12 in the CBRUXENT exit routine and lets OAM on a system of PLEX1 define the volume.

The same definition prevents access from all systems of PLEX1 to volumes that belong to PLEX2.

Therefore, we recommend defining naming conventions on all systems to allow easy distinction between volumes of either SMSplex.

5.3.3 Operational Considerations

Partitioning implies dedication of tape volumes and tape drives to a system or an SMSplex. Scratch volumes are separated by means of different Library Manager volume categories. Special considerations apply for the use of private volumes and the assignment of tape drives.

5.3.3.1 Access to Private Volumes

To prevent private volumes from being used by another system, you need to code the CBRUXENT exit routine. When using DFSMSrmm, specify the REJECT parameter.

Currently, there is no support for accessing private volumes from different SMSplexes. Although it is not recommended, if you need access to a private volume belonging to another SMSplex, you could use the following approach:

1. The owning partition—the partition that initially created the volume—always retains ownership for the volume. The DFSMSrmm and TCDB entries are not changed.
2. Use IDCAMS to create a volume entry in the TCDB of the other partition, specifying all of the information contained in the TCDB of the owning partition. Figure 41 on page 105 shows a sample job to create a volume record in the TCDB.

```
//CREATVOL JOB ...
//STEP1   EXEC PGM=IDCAMS
//SYSPRINT  DD SYSOUT=*
//SYSIN     DD *
  CREATE VOLUMEENTRY -
  NAME(volser) -
  RECORDING(128TRACK) -
  MEDIATYPE(MEDIA3) -
  LIBRARYNAME(library) -
  STORAGEGROUP(storagegroupname) -
  USEATTRIBUT(PRIVATE) -
  NOWRITEPROTECT -
  LOCATION(LIBRARY) -
  SHELFLOCATION(shelflocation) -
  OWNERINFORMATION('owning system or user') -
  ENTEREJECTDATE(1995-10-10) -
  EXPIRATIONDATE(2999-12-31) -
  WRITEDATE(1995-10-10) -
  MOUNTDATE(1995-10-10)
/*
```

Figure 41. Sample IDCAMS Job to Create a TCDB Volume Record

Note: ALTER, CREATE, and LISTCAT Access Method Services (AMS) commands have been changed to support the new media type (MEDIA3) and recording technology (128TRACK) of the IBM 3590 tape subsystem.

For more information about creating records in the TCDB, please refer to the *DFSMS/MVS V1R3 Access Method Services for the Integrated Catalog Facility*.

3. The additional partition uses the volume only in input mode and never returns it to scratch.
4. When the owning partition returns the volume to scratch, the user must update the TCDB for the other partition through IDCAMS to delete the volume entry from the inventory or not access the volume until the owning partition creates data on it.
5. If you are using DFSMSrmm, you need to update its control data set accordingly.

The above approach is not recommended for daily operation because the use of IDCAMS to update the TCDB should be limited to disaster recovery situations only. In addition, if both partitions try to access the volume simultaneously, the second requester will fail. If the second requester is the owning partition, users could become confused.

5.3.3.2 Drive Sharing and Cartridge Loading Considerations

For drive sharing, the same considerations as for nonlibrary devices apply. If you are using an IBM 3495 and occasionally need to reassign a tape drive to another system of another SMSplex, you must consider that the new system does not know about the media type that is assigned to that drive. In addition, the scratch cartridges loaded into the ICL/ACF of the drive cannot be used by the new system. To fill the ICL/ACF with cartridges of the correct media type, you need to use the MVS LIBRARY SETCL command. Figure 42 on page 106

summarizes the ICL/ACF considerations when reassigning a tape drive to a system of a different partition.

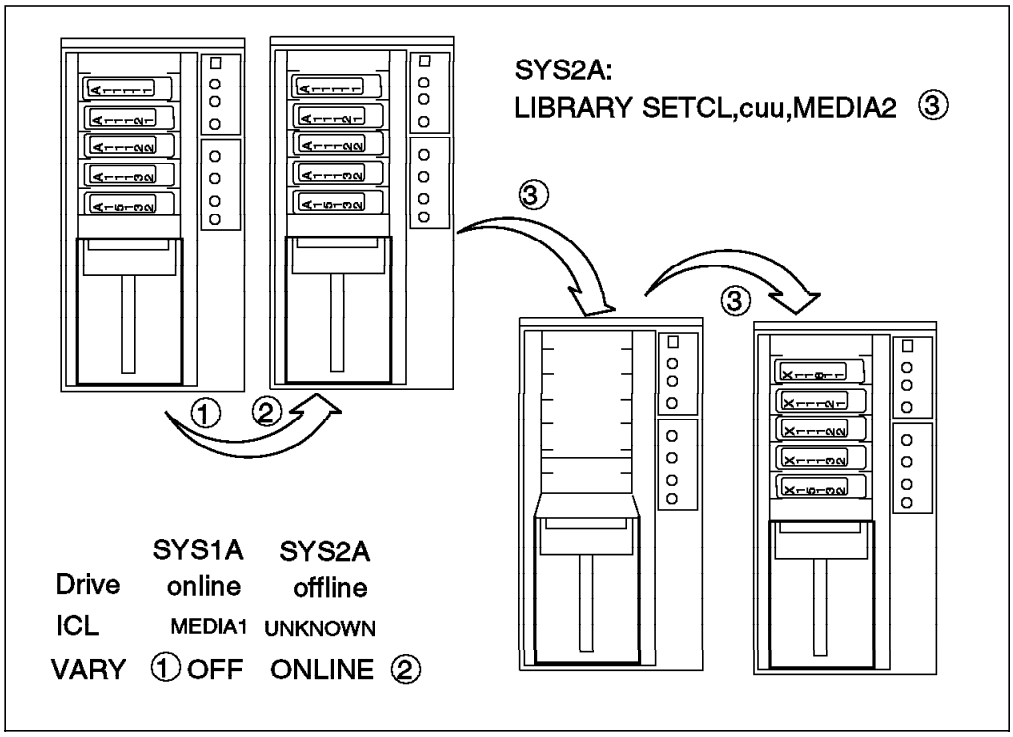

Figure 42. Reassigning Tape Drives to a Different SMSplex

Initially, the drive in Figure 42 is online to system SYS1A of PLEX1. The cartridges in the ICL/ACF are MEDIA1 and belong to PLEX1. When assigning the drive to system SYS2A of PLEX2, perform the following steps:

1. Vary the drive offline to SYS1A.

   The cartridges in the cartridge loader belong to the MEDIA1 category used by PLEX1. The ICL/ACF is not emptied upon VARY OFFLINE.

2. Vary the drive online to SYS2A.

   The cartridges in the ICL/ACF still belong to PLEX1. Issuing the LIBRARY,DISPCL command shows a media type of UNKNOWN on SYS2A.

3. Assign the drive a media type used by SYS2A. The ICL/ACF will be emptied and filled with scratch volumes belonging to SYS2A′s volume category MEDIA2.

5.4 Partitioning between DFSMS/MVS and Non-SMS Environments

DFSMS/MVS can process only those tape volumes that are defined in its TCDB and optionally to DFSMSrmm. In a partitioned environment, the cartridge entry installation exit routine can assure that the DFSMS/MVS system only performs insert processing for volumes that should be used by DFSMS/MVS. However, depending on the system software on the other partition, different considerations apply.

We discuss implementation considerations for every platform in this section. We also describe how volumes and drives can be used in a partitioned environment.

5.4.1 DFSMS/MVS and VM/ESA

In DFSMS/VM, you can define the volumes to be used by specific users in a control file or any other mechanism that can be used by the FSMRMSHR exit. This exit is invoked for every MOUNT, SET DEVCAT, and SET VOLCAT command to determine the validity of the request.

You can partition your IBM Automated Tape Library between a DFSMS/MVS and a DFSMS/VM system, either sharing private volumes or not sharing them. You cannot share scratch volume pools, because the Library Manager volume categories that VM/ESA and MVS/ESA use are different.

5.4.1.1 Implementation Considerations

You need to code the cartridge installation exit routine and the volume not in library installation exit routine for the same reasons as when you partition your IBM Automated Tape Library between multiple SMSplexes.

You need to code the FSMRMSHR exit routine on the VM/ESA side in order to allow or disallow access to specific volumes or ranges of volumes.

We recommend that you use volume serial naming conventions that allow you to differentiate between VM/ESA and MVS/ESA tape volumes. Thus, insert processing can be done by the appropriate system:

- By MVS/ESA according to the definitions in DFSMSrmm and the cartridge entry installation exit
- By VM/ESA according to the definitions in the on-request bulk processing file and the automatic-insert bulk processing file.

Add all private VM/ESA tapes to the TCDB if you want to share them.

5.4.1.2 DFSMSrmm Considerations

When using DFSMSrmm, we strongly recommend that you predefine all tapes to DFSMSrmm before inserting them into the IBM Automated Tape Library. This allows you to ignore all volumes that are not predefined to DFSMSrmm and have another system perform the insert processing.

DFSMSrmm allows you to define VM/ESA tapes as well. Specify USE(MVS,VM) to add private volumes to DFSMSrmm that you want to share between DFSMS/MVS and DFSMS/VM. If you specify USE(VM) only, the volume is not processed on the MVS/ESA system, and no volume entry in the TCDB is created. If you want to prevent the MVS/ESA system from using VM/ESA tapes, define the volumes belonging to VM/ESA as USE(VM) only.

Use the REJECT command in SYS1.PARMLIB member EDGRMMxx to restrict the use of tapes to those volumes defined to DFSMSrmm. Figure 43 shows sample REJECT commands.

```
REJECT ANYUSE(*)
REJECT OUTPUT(VM*)
```

Figure 43. Sample REJECT Commands in PARMLIB Member EDGRMMxx

The first REJECT command in Figure 43 restricts the use of tape volumes on the MVS/ESA system to those defined to DFSMSrmm. You can use the DFSMSrmm

installation exit EDGUX100 to request that DFSMSrmm ignore tapes that are not defined, if you need to process foreign tapes for example.

The second REJECT statement restricts the use of tapes starting with the characters VM/ESA in their labels to input processing only. Define the VM/ESA tapes to be read by MVS/ESA by using the OUTPUT parameter.

Note: The most specific prefix defined in any REJECT command will be used.

5.4.1.3 Sharing Volumes

You can share private volumes between a VM/ESA system and your SMSplex but you cannot share scratch volumes. DFSMS/VM uses different scratch pools and different Library Manager volume categories.

Volumes that should be processed by a DFSMS/MVS system must adhere to the SMS labeling requirements. DFSMS/MVS supports the following label types:

- IBM standard labels (SL)
- ISO/ANSI/FIPS labels (AL)
- Both IBM standard and user header or trailer labels (SUL)
- Both ISO/ANSI/FIPS and user header or trailer labels (SUL).

Note: Support for internal unlabeled tapes (NL and BLP) is provided through APARs until DFSMS/MVS 1.3. The APAR OW01530 and OW05934 are for DFSMS/MVS 1.1 and APAR OW01530 and OW06305 are for DFSMS/MVS 1.2. Please note that the NL and BLP output processing is not supported in an IBM 3495 M10 Manual Tape Library Dataserver for reasons of data integrity.

If you want a private volume to be shared between MVS/ESA and VM/ESA, you can use the following approach:

1. Define the volume to DFSMSrmm as a private tape with USE(MVS,VM).
2. Do not specify this volume in any of VM/ESA′s bulk processing files.
3. Insert the volume into the IBM Automated Tape Library.
4. Let MVS/ESA perform the insert processing.
5. Enable VM/ESA to access the volume by enabling its use through FSMRMSHR.
6. **Ensure that only one platform issues a mount request for a shared volume at one point in time**.

If you want to allow the MVS/ESA system to access a private volume that has been created on the VM/ESA system and is already inside the IBM Automated Tape Library, perform the following steps:

1. Add the volume to DFSMSrmm by specifying USE(MVS,VM).
2. Add an appropriate REJECT OUTPUT command to SYS1.PARMLIB member EDGRMMxx.
3. Use IDCAMS to create a volume entry for this volume in the TCDB.

If you want to allow the VM/ESA system to access a tape volume that has been created by MVS/ESA, add its volume serial number to FSMRMSHR.

We assume for all approaches that the installation exit routines are in place.

If a shared volume is returned to scratch on either system, the volume must be deleted from the other system's inventory in order to prevent access to the tape. The volume should always be returned to scratch on the owning system.

5.4.1.4 Sharing Tape Drives

Sharing tape drives between a VM/ESA and an MVS/ESA system can be achieved by reassigning the drives from one system to the other. Figure 44 shows two MVS/ESA systems running as guests under VM/ESA. In this sample configuration, two tape drives, A00 and A10, are assigned to MVS1. Drive A11 is assigned to VM1, and drive A01 to MVS2. The MONT3494 service machine receives mount requests from users and routes the requests to RMSMASTR.

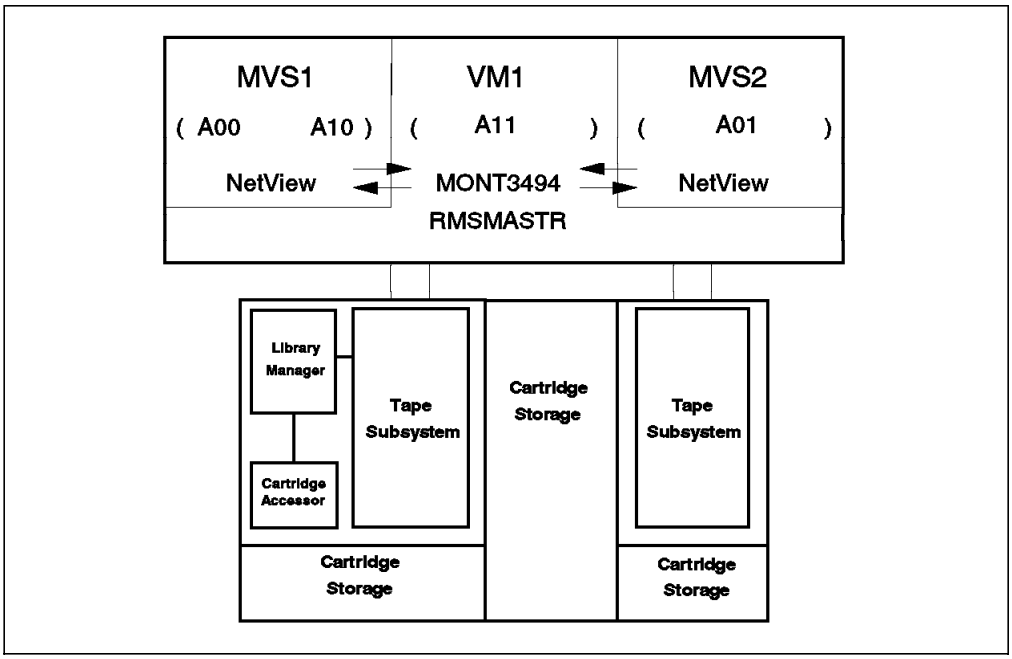

Figure 44. Sharing Tape Drives between VM/ESA and MVS/ESA Systems

Figure 45 on page 110 shows what happens if RMSMASTR does not have a free tape drive:

1. The MONT3494 service machine sends a message to both NetViews every few minutes.
2. NetView on MVS2 finds an available tape drive. It varies the drive offline and sends a formatted message to MONT3494.
3. The MONT3494 service machine detaches the tape drive from MVS2 and attaches it to RMSMASTR.

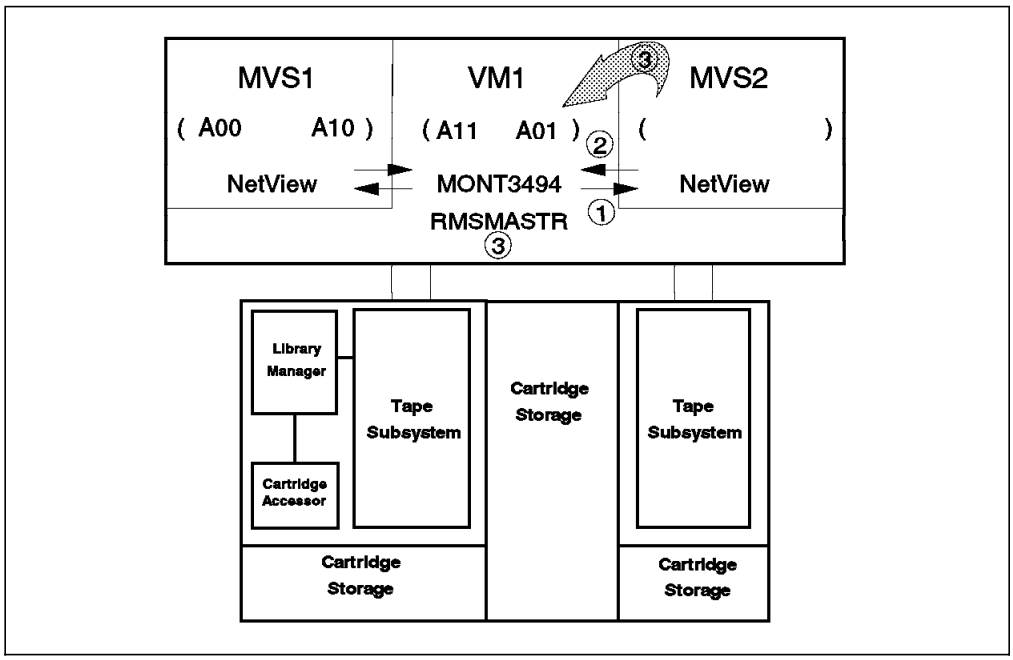

Figure 45. Sharing Tape Drives between VM/ESA and MVS/ESA Systems

After the tape drive is no longer needed, MONT3494 detaches the tape drive from RMSMASTR and attaches it to MVS2. When NetView gets the message that the tape drive has been attached again, it varies the drive online.

This scenario is based on VMTAPE and ADSM using the IBM Automated Tape Library because both repeat their requests until they get a tape drive.

5.4.2 DFSMS/MVS and BTLS

When partitioning an IBM Automated Tape Library between an SMS system and a BTLS system, the same considerations apply as described in 5.3, “Partitioning between Multiple SMSplexes” on page 98.

You cannot share tape volumes between partitions. If you want to access a volume on the BTLS partition, which was originally created on the DFSMS/MVS partition, you need to define it in the BTLS catalog first. If you request a specific mount for a volume serial number that is not defined in the BTLS catalog (on the BTLS system) but resides in the IBM Automated Tape Library, the allocation will be to a tape drive outside the IBM Automated Tape Library.

For information about how to transfer volumes to the BTLS partition and process volumes from the BTLS partition, please refer to 5.5, “Volume Transfer” on page 111.

Tape drives cannot be shared between partitions unless both the partitions use Sysplex shared tape support on MVS/ESA Version 5 Release 2. If you want to switch tape drives between partitions, you need to follow the same steps as described in 5.3, “Partitioning between Multiple SMSplexes” on page 98.

5.4.3 DFSMS/MVS and Other Platforms

The partitioning of an IBM Automated Tape Library between a DFSMS/MVS system and a system on another platform, for example AIX/6000, OS/400, TPF, or VSE/ESA native support, is the same as for the DFSMS/MVS system: You need to make sure that only volumes intended to be used by the DFSMS/MVS system are added to the TCDB during insert processing. DFSMS/MVS provides the strictest control regarding access to the library.

There is no dynamic drive sharing between DFSMS/MVS and systems of other platforms. You have to vary drives offline on the DFSMS/MVS system and assign them to the other system if you want to switch them from the MVS/ESA system to the other system.

5.5 Volume Transfer

In a DFSMS/MVS environment, a volume inside an IBM Automated Tape Library can be processed only if a volume record exists in the TCDB. Currently, there is no support in DFSMS/MVS to logically transfer a volume to another system by means of removing the volume entry from the TCDB and assigning a different Library Manager volume category.

5.5.1 Transferring Volumes to Another System

If you want to transfer a volume from a DFSMS/MVS system to another host system, you need to remove the volume record from the TCDB. The volume entry in the TCDB is deleted when the volume is ejected from the IBM Automated Tape Library and you have an EJECT default of PURGE specified for the IBM Automated Tape Library.

A second alternative is to delete the TCDB volume record using IDCAMS and to add the volume information to the target host inventory. However, we recommend not using IDCAMS other than in recovery situations. Using IDCAMS to add and remove volume records in the TCDB can result in inconsistencies between the Library Manager database and the host inventory.

If you want to transfer a volume permanently to another system, you need to:

- Remove the volume entry from the DFSMSrmm control data set using the DELVOL command or the ISPF interface.
- Remove the volume entry from the TCDB.
- Make sure that if the volume is ejected from the IBM Automated Tape Library and entered again, insert processing will be performed on the other host.

If you want to transfer a volume temporarily to another host and can ensure that the volume will not be requested by the DFSMS/MVS system concurrently, you can follow the recommendations for sharing private volumes given in Chapter 5, “Implementation in a DFSMS/MVS Environment” on page 87.

Note: When transferring a volume to another host, the volume still remains in the Library Manager category to which DFSMS/MVS had the volume assigned. On the receiving system, you should only request the volume by its volume serial number. If you want to add the volume to another host′s scratch category, you need to assign the appropriate library manager category.

5.5.2 Receiving Volumes from Another Host System

If a volume is transferred from another host, DFSMS/MVS can either accept the volume permanently or use it only temporarily. If the volume is to be used permanently, you must define it to DFSMSrmm and perform regular insert processing. If the volume is to be used only temporarily, you must add the volume record to the TCDB. However, you could request that DFSMSrmm ignore the tape volume using the DFSMSrmm installation exit routine EDGUX100. After you have processed the tape, either eject it from the library or delete the volume record from the TCDB.

Chapter 6. Implementation in a Basic Tape Library Support Environment

In this chapter, we review the basic factors to consider when implementing BTLS for sharing and partitioning an IBM Automated Tape Library among multiple systems. First, we explain the basic BTLS implementation tasks. Then we examine the general considerations for sharing and partitioning an IBM Automated Tape Library with BTLS. Finally, we address the tape management system and recovery considerations in a BTLS environment. For an overview of BTLS, see 3.2, “MVS/ESA and Basic Tape Library Support” on page 41.

6.1 Implementation Tasks

In this section, we explain the basic implementation tasks of BTLS.

6.1.1 Control Data Sets

BTLS uses catalog records to define a library configuration and allocation rules. Each volume in an IBM Automated Tape Library is also defined by a catalog record that names the library in which the volume resides. You need to allocate a user catalog for the BTLS volume entries. Table 16 shows the catalog records that BTLS uses.

Table 16. BTLS Catalog Records

Type	Catalog Record Name	Description
Library	SYS1.BTLS.LIB.LIBn	Defines the device addresses in library LIBn
Options	SYS1.BTLS.LIB.OPT	Defines the options used by an allocation
Jobname	SYS1.BTLS.JOBn	Defines the job names that should use a library scratch allocation
Volume	BTLS.BTLS.VOL.vvvvvv	Indicates the library containing volume vvvvvv

Catalog records whose names start with SYS1 are cataloged in the master catalog. The volume catalog records are cataloged in the BTLS user catalog.

Figure 46 on page 114 shows BTLS catalog record structure.

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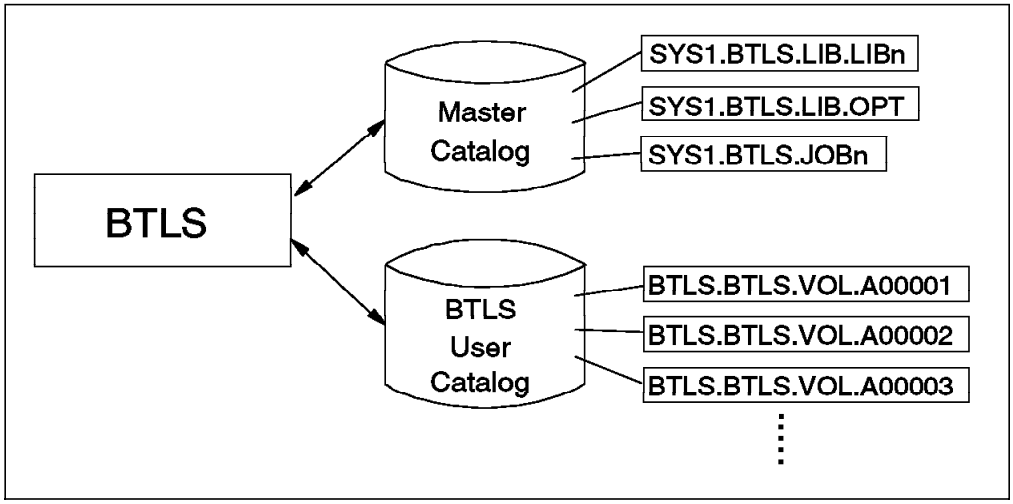

Figure 46. BTLS Catalog Record Structure

6.1.2 Installation Tasks

In this section, we describe the BTLS installation tasks. For more information about installation tasks and details of the AMS command, LIBRARY, see the *Basic Tape Library Support Version 1 Release 1 User's Guide and Reference*.

The installation tasks are:

1. Define the AMS command, LIBRARY, as a TSO command.

   To define the AMS command, LIBRARY, as a TSO command, use the job control language (JCL) shown in Figure 47.

```
//COMMAND  JOB ,
//         TIME=(0,5),MSGCLASS=A
//LKED     EXEC  PGM=HEWL,REGION=2048K,
//       PARM='XREF,LET,RENT,LIST,NCAL'
//SYSUT1   DD  DSN=&&SYSUT1, UNIT=SYSDA,
//       SPACE=(1024,(50,20))
//SYSPRINT DD  SYSOUT=*
//SYSLMOD  DD  DSN=SYS1.LINKLIB,DISP=SHR
//SYSLIB   DD  DSN=SYS1.CMDLIB,DISP=SHR
//SYSLIN   DD
  INCLUDE SYSLIB(IDCAM01)
  ALIAS   LIBRARY
  SETCODE AC(1)
  NAME IDCAM01(R)
/*
```

Figure 47. Sample JCL to Define AMS Command, LIBRARY, As a TSO Command

   Authorize the AMS command, LIBRARY, by adding it to IKJTSO00 in SYS1.PARMLIB. After updating IKJTSO00, the PARMLIB UPDATE(00) command will authorize the AMS command, LIBRARY.

2. Define library devices.

   Use the AMS command, LIBRARY DEVICES, to define the device addresses for a library. A 3490 control unit can contain up to 16 tape drives. Even if any of the control units in an IBM Automated Tape Library has less than 16

drives, all 16 possible addresses still must be defined in the host system. It is necessary to include uninstalled devices in the AMS command, LIBRARY DEVICES. If invalid addresses are specified, the results will be unpredictable. Figure 48 shows a sample job to define library devices. Library LIB1 (default) is defined as containing devices 180-18F and 190-19F.

```
//LIBJOB     JOB
//           EXEC PGM=IDCAMS
//SYSPRINT   DD   SYSOUT=*
//SYSIN      DD   *
  LIBRARY DEVICES ( 18018F 19019F )
/*
```

Figure 48. Sample JCL to Define Library Devices

Recording technology (18-track or 36-track) information is not kept in a BTLS environment. Therefore, with mixed device types and mixed media types in an IBM Automated Tape Library, we recommend that you define two logical libraries, such as LIB1 for the IBM 3490 tape subsystem and LIB2 for the IBM 3490E tape subsystem, to facilitate the conversion to DFSMS tape and control use of the device and media types. Figure 49 shows a sample command to define two logical libraries.

```
LIBRARY DEVICES (17017F) LIBNAME(LIB1)
LIBRARY DEVICES (18018F) LIBNAME(LIB2)
```

Figure 49. Sample Command to Define Three Logical Libraries

Note: BTLS support for four-digit device numbers is provided as follows:

- Support is provided with JDZ11BS.
- For releases prior to JDZ11BS, support is provided by OW12877.
- Library devices must be restricted to the four-digit address range 0000-0FFF.
- All other devices, including tape drives can use any of the four-digit addresses in the range 0000-FFFF.
- BTLS commands and messages use only the three significant digits 000-FFF and assume that the fourth digit is always zero.

Note: When BTLS is installed as a VM/ESA guest on a virtual machine, specify the following statement in the virtual machine directory entry to allow BTLS to control a tape library:

```
STDEVOPT LIBRARY CTL
```

3. Create esoteric device group name.

Create an esoteric device group name for the library devices to facilitate allocation to the IBM Automated Tape Library. The esoteric device group name does not have to match the library name (for example, LIB1), but the address range of the esoteric device group name must match the library device definitions to ensure that allocation recovery messages include only the appropriate set of tape drives.

4. Create SYS1.PARMLIB member BTLPRM00.

   Define the defaults used by BTLS in SYS1.PARMLIB member BTLPRM00. Each parameter statement must begin in column 1. The following definitions are supported:

   THRESHOLD(*count*) Establishes a low threshold value for scratch volumes. When the number of scratch volumes falls below the *count*, the operator receives a warning message.

   The threshold value established at IPL by the THRESHOLD parameter is replaced when the AMS command, LIBRARY THRESHOLD, is executed. If more than one threshold value is required, use the AMS command, LIBRARY THRESHOLD, after IPL. The command supports multiple libraries and multiple scratch categories. The LIBRARY REPORT command can be used to display the threshold values that have been established.

   SCRTCHn Establishes a default category for scratch mounts. Unless specified, scratch mounts use volumes assigned to the SCRTCH1 volume category (X′0FFF′). When more than one host shares a library, a different scratch volume category can be used by each host. The BTLPRM00 PARMLIB member for each host names the scratch volume category that host will use for scratch mounts.

   AUTODEMOUNT Indicates that library volumes should be automatically demounted if they become mounted on unallocated devices. When AUTODEMOUNT is specified and BTLS detects a mount completion for an unallocated device, the volume is unloaded and demounted automatically.

   In a BTLS library, a volume can become mounted on an unallocated device when a job is cancelled or abends during *mount pending*. Because the mount is not completed before the job terminates, a demount is not sent to the library. Even though the job is terminated, the mount will eventually be completed in the library. If the device has not yet been allocated to another job, the volume will stay mounted.

   The purpose of AUTODEMOUNT is to solve the following two problems created by volumes mounted on unallocated drives:

   - If another job allocates the drive and needs a private volume mounted, the job will demount but keep the previously mounted volume. The demount will cause a scratch volume to be assigned to the private category even though it was never used.
   - If another job allocates a different tape drive and needs a volume that is already mounted on an unallocated drive, the mount will fail with the message ERA=64 (volume in use).

   LIBAFFINITY indicates that BTLS should break affinity when an invalid UNIT=AFF condition is detected. If LIBAFFINITY is not used, invalid affinity is reported by message BTLS104I and the job is terminated.

   In order to validate affinity, BTLS compares the allocation requirements of the target DD(DD1) and the UNIT=AFF DD(DD2). The following conditions are valid:

   - Both DD1 and DD2 require drives in the same library.

- Both DD1 and DD2 require nonlibrary drives.
- Either DD1 or DD2 can use *any* drive. BTLS allows *any* drive when Option I is used to control scratch allocation and for any SCRTCH request that specifies UNIT=AFF.

When an invalid condition is detected, and the LIBAFFINITY option is in effect, BTLS breaks the invalid affinity. The following example shows how BTLS will break affinity.

```
//DD1  DD  VOL=SER=VOL001,UNIT=TAPE
//     DD  VOL=SER=VOL002,UNIT=AFF=DD1
//     DD  VOL=SER=VOL003,UNIT=AFF=DD1
//     DD  VOL=SER=VOL004,UNIT=AFF=DD1
```

Note: VOL001 and VOL004 are defined to BTLS as LIB1, VOL002 and VOL003 are not defined to BTLS

When the above JCL is executed, BTLS directs the allocation for DD1 into LIB1, but detects an error because VOL002 is not in LIB1 yet specifies affinity with DD1. When the LIBAFFINITY option is in effect, BTLS causes the JCL to allocate as if it were written as follows:

```
//DD1  DD  VOL=SER=VOL001,UNIT=TAPE
//DD2  DD  VOL=SER=VOL002,UNIT=TAPE
//     DD  VOL=SER=VOL003,UNIT=AFF=DD2
//     DD  VOL=SER=VOL004,UNIT=AFF=DD1
```

In order for LIBAFFINITY to successfully break affinity, the set of devices determined by the UNIT parameter of the target DD must include devices that will also satisfy the requirements of the broken DD.

If the example JCL was coded as follows, the allocation for VOL002 fails because UNIT=LIB1DEVS names an esoteric that does not include any devices in LIB2 (and VOL002 is defined to BTLS as a LIB2 volume).

```
//DD1  DD  VOL=SER=VOL001,UNIT=LIB1DEVS
//     DD  VOL=SER=VOL002,UNIT=AFF=LIB1
//     DD  VOL=SER=VOL003,UNIT=AFF=LIB1
//     DD  VOL=SER=VOL004,UNIT=AFF=LIB1
```

Note: LIBAFFINITY is not supported when MVS/SP 5.2 is installed.

EXPDT98000 | EXPD The EXPDT98000 option allows a duplicate of a BTLS library volume to be mounted on a drive outside the library.

When the EXPDT98000 option is used, and a DD statement includes EXPDT=98000, BTLS will not validate or interfere with the allocation. This allows you to allocate a drive outside the library for a volume serial number that is defined to BTLS as a library volume.

5. Define user catalog for BTLS volume records.

Define a usercatalog named BTLS that will be used by BTLS to define ′BTLS.BTLS.VOL.volser′ catalog records. The catalog must be an ICF catalog and may be defined as shared if library volumes are to be shared by more than one host. If this catalog is to be shared by more than one host, the catalog must reside on a shared DASD volume, and must be connected

to the master-catalogs of the other hosts. Figure 50 on page 118 shows a sample command to define the user catalog.

```
DEFINE UCAT  (NAME(BTLS) MEGABYTES(1 1) ICFCATALOG -
              VOLUME(COMCAT) SHAREOPTIONS(3 4))
```

Figure 50. Sample Command to Define the User Catalog

6. Install the BTLS allocation interface.

   For releases prior to MVS/SP 5.1 ensure that APAR OY63009 is installed (OY63009 is included with MVS/SP 5.1). OY63009 provides the interface used by BTLS to control tape allocations.

   OY63009 is not used with MVS/SP 5.2. Instead, BTLS uses the tape allocation subsystem interface. When MVS/SP 5.2 is installed, add the following command to SYS1.PARMLIB member IEACMD00:

   ```
   SETSSI ADD,SUBNAME=BTLS,INITRTN=AOMALSSI
   ```

   You can also issue the SETSSI command from the operator's console. The SETSSI command activates the BTLS Tape Allocation SSI so that BTLS can begin to control tape allocations. When the command executes, the following messages should be received at the operators console:

   ```
   BTLS401I START OF BTLS INITIALIZATION
   BTLS402I BTLS INITIALIZATION COMPLETE
   ```

7. Obtain an inventory list from the library.

   Use the AMS command, LIBRARY INVENTORY, to obtain a list of the volumes in the INSERT category in the IBM Automated Tape Library. The volume list is printed in the data set of the LIBOUT DD statement.

   Figure 51 shows a sample job to obtain a list of the volumes in the INSERT category.

```
//LIBJOB     JOB
//           EXEC PGM=IDCAMS
//SYSPRINT   DD   SYSOUT=*
//LIBOUT     DD   DSN=dsname,
//         DISP=(NEW,CATLG),UNIT=SYSDA,
//         DCB=(LRECL=80,BLKSIZE=0,RECFM=FB)
//SYSIN      DD   *
  LIBRARY INVENTORY UNIT(180) CATEGORY(INSERT)
/*
```

Figure 51. Sample JCL to Obtain a Volume List

8. Set volume category

   Determine which volume serial number should be the private category and which should be the scratch category, then issue the AMS command, LIBRARY SETCATEGORY, to assign each volume to the appropriate category. Figure 52 on page 119 shows a sample job where all volumes specified in the LIBIN DD data set are assigned to the SCRTCH category.

```
//LIBJOB     JOB
//           EXEC PGM=IDCAMS
//SYSPRINT   DD   SYSOUT=*
//LIBIN      DD   DSN=dsname,DISP=SHR
//SYSIN      DD   *
  LIBRARY SETCATEGORY UNIT(180) CATEGORY(SCRTCH)
/*
```

Figure 52. Sample JCL to Assign Volumes to a Category

With mixed media types in an IBM Automated Tape Library, we recommend that you set different volume categories for each media type to facilitate the conversion to DFSMS tape and control use of the media types.

9. Create volume records.

   Use the AMS command, LIBRARY DEFINE, to create a volume record for each volume. Figure 53 shows a sample job to create volume records for the volumes. All volumes specified in the LIBIN DD data set are cataloged as residing in library LIB1 (default).

```
//LIBJOB     JOB
//           EXEC PGM=IDCAMS
//SYSPRINT   DD   SYSOUT=*
//LIBIN      DD   DSN=dsname,DISP=SHR
//SYSIN      DD   *
  LIBRARY DEFINE
/*
```

Figure 53. Sample JCL to Create Volume Records

For a specific volume request (PRIVATE volume), if the volume is not defined in this catalog entry as a library volume, the volume is assumed to reside outside the library, and only nonlibrary devices are used to satisfy the allocation.

10. Create operational procedure.

    Create a procedure to be used by the operator to issue the IBM Automated Tape Library mounts and demounts. The procedure should invoke the AMS command, LIBRARY.

11. Define options for scratch allocation.

    Use the AMS command, LIBRARY OPTIONS, to define the BTLS options. Figure 54 shows a sample job to define the BTLS options. The options JEE indicate that scratch allocations to LIB1 (default) should be based on job names that are defined in step 11 and that BTLS allocation and dynamic device reconfiguration (DDR) support should be enabled.

```
//LIBJOB     JOB
//           EXEC PGM=IDCAMS
//SYSPRINT   DD   SYSOUT=*
//SYSIN      DD   *
  LIBRARY OPTIONS (JEE)
/*
```

Figure 54. Sample JCL to Define BTLS Options

12. Define job names for scratch allocation.

    Use the AMS command, LIBRARY JOBNAMES, to define the names of jobs that should use the IBM Automated Tape Library for scratch allocation. This step is required only if the BTLS option *J* is defined in step 10. Figure 55 shows a sample job to define the job names. The TAPELIB1 job as well as any jobs with job names beginning with AUTO or HSM will use LIB1 (default) for scratch allocation.

```
//LIBJOB     JOB
//           EXEC PGM=IDCAMS
//SYSPRINT   DD   SYSOUT=*
//SYSIN      DD   *
  LIBRARY JOBNAMES ( TAPELIB1 AUTO HSM )
/*
```

Figure 55. Sample JCL to Define Job Names

13. Secure the AMS command, LIBRARY.

    If you want to control use of the AMS command, LIBRARY, define IDCLI01 to RACF as a resource name within the RACF resource class, PROGRAM. This definition allows only authorized users to send requests to the IBM Automated Tape Library. Figure 56 shows a sample command to define IDCLI01 to RACF.

```
RDEFINE PROGRAM IDCLI01 UACC(NONE)
PERMIT IDCLI01 CLASS(PROGRAM) -
       ID(oper)               -
       ACCESS(READ)
```

Figure 56. Sample Command to Define IDCLI01 to RACF

14. Create internal volume label.

    Use IEHINITT to label any cartridges that require internal volume labels.

    Reply “M” to console message IEC701D for each volume. When volumes are demounted by IEHINITT, they are assigned to the PRIVATE category. The AMS command, LIBRARY SETCATEGORY, should be used to assign the volumes to the appropriate category.

6.1.3 Installation Exits

Installation exits are provided to allow you to extend or replace the BTLS replaceable module. The exits are optional. For sharing and partitioning an IBM Automated Tape Library in a BTLS environment, you do not need to customize the system by using the installation exits.

For details on the installation exits discussed below, see the *Basic Tape Library Support Version 1 Release 1 User’s Guide and Reference*.

6.1.3.1 Set Volume Category

The set volume category installation exit, IDCLI04, is called by IDCLI01 when the SETCEXIT command is specified. This installation exit allows you to specify the volume serial number and *category* to be sent to the IBM Automated Tape Library as a SETCATEGORY request.

6.1.3.2 Allocation

The allocation installation exit, AOMABEXT, can be used to control library allocation. It can influence an allocation in one of the following ways:

- Do nothing.
- The allocation should be directed to a device in the specified library.
- The allocation should be directed to a device in any library.
- The allocation should exclude all library devices.

6.1.3.3 Message Display

When BTLS is installed, the message display installation exit (IGXMSGEX) can be used to select a BTLS scratch category that will satisfy a library scratch mount. If one of the supported scratch categories is specified to the message display installation exit, that scratch category is used to override the scratch category that would otherwise be used.

6.1.4 JES3 Considerations

JES3 provides BTLS support as follows:

- The tape subsystems in the IBM Automated Tape Library Dataserver must not be defined in the JES3 initialization deck and therefore are not managed by JES3.
- MVS performs all IBM Automated Tape Library Dataserver tape device allocations with the allocation assist function of BTLS. BTLS is responsible for communication with the Library Manager in the IBM Automated Tape Library Dataserver.
- BTLS functions in the JES3 environment are identical to the BTLS functions in the JES2 environment.
- JES3 tape dynamic support programs (DSPs) or JES3 tape commands for tape drives inside an IBM Automated Tape Library Dataserver are not supported.

JES3 can continue to manage tape devices outside the IBM Automated Tape Library Dataserver as long as those devices do not belong to the same generic or esoteric unit types as tape devices inside the IBM Automated Tape Library Dataserver. For example, you must not have JES3-managed 3490E devices outside the IBM Automated Tape Library Dataserver while there are IBM 3490E devices inside the IBM Automated Tape Library Dataserver. You can have JES3-managed IBM 3480 and/or 3490 base devices (non-3490E) outside of the IBM Automated Tape Library Dataserver while the devices inside the IBM Automated Tape Library Dataserver are all IBM 3490E.

The IBM 3490 base devices (non-3490E) are identical to IBM 3480 devices as far as MVS/JES3 is concerned. Therefore you cannot have IBM 3490 base devices (non-3490E) inside the IBM Automated Tape Library Dataserver and JES3-managed IBM 3480 or 3490 base (non-3490E) devices outside the library.

6.2 Partitioning

In this section, we explain implementation considerations for partitioning an IBM Automated Tape Library between a BTLS system and other systems. We explain the general considerations for partitioning an IBM Automated Tape Library in Chapter 4, “Multisystem Access” on page 63.

6.2.1 Two BTLS Systems

Partitioning an IBM Automated Tape Library for multiple BTLS systems requires that each BTLS own its own BTLS user catalog for controlling tape drives and volumes. Figure 57 shows the partitioning of an IBM Automated Tape Library between two BTLS systems.

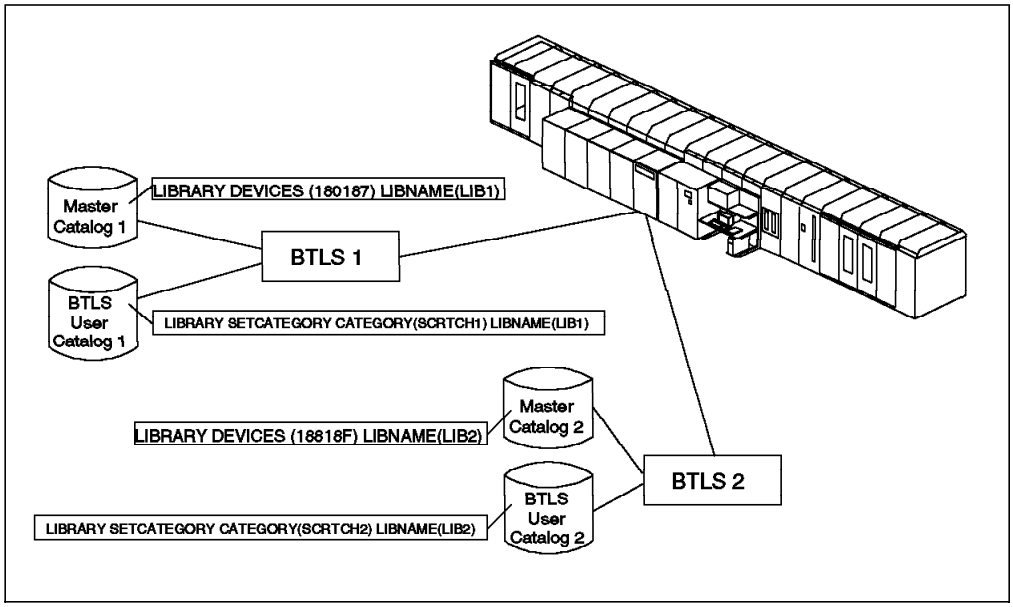

Figure 57. Partitioning between Two BTLS Systems

6.2.1.1 Volume Assignment

In a BTLS environment, eight scratch categories can be used. You can use a different scratch category for each BTLS system to partition scratch cartridges inside an IBM Automated Tape Library. One set of scratch cartridges can be assigned to one BTLS system, and a different set of scratch cartridges can be assigned to another BTLS system.

In a BTLS environment, you can use only those volumes that are defined in the BTLS user catalog. To partition the private volumes for two BTLS systems, you must define one set of volumes to one BTLS system, and a different set of volumes to the other BTLS system.

6.2.1.2 Drive Assignment

A BTLS system can use only those tape drives that are defined by the AMS command, LIBRARY DEVICES. You can define one set of tape drives for one BTLS system and a different set of tape drives for the other BTLS system. You should create an esoteric device group name for each group of library devices to facilitate allocation to the IBM Automated Tape Library. The esoteric device group names must match the library device definitions to ensure that allocation recovery messages include only the appropriate set of tape drives.

If you want to associate a scratch category with a tape drive used by a BTLS1 system by using the AMS command, LIBRARY SETDEVICE, you must make sure that the scratch category name used by BTLS1 matches the scratch category name on the drive owned by BTLS1. If you wrongly associate a scratch category with a tape drive used by a BTLS1 system, for example, you associate a scratch category used by a BTLS2 system, the Library Manager mounts the scratch volumes for the BTLS2 system, and the BTLS1 system uses the scratch volumes of the BTLS2 system.

To reassign tape drives to another system, the same considerations apply as discussed in 4.3.2, “Drive Assignment and Cartridge Loading” on page 73.

6.2.2 BTLS System and Another System

For partitioning an IBM Automated Tape Library between a BTLS system and another system, the same considerations apply as discussed in 6.2.1, “Two BTLS Systems” on page 122.

Figure 58 shows the partitioning of an IBM Automated Tape Library between a BTLS and another system.

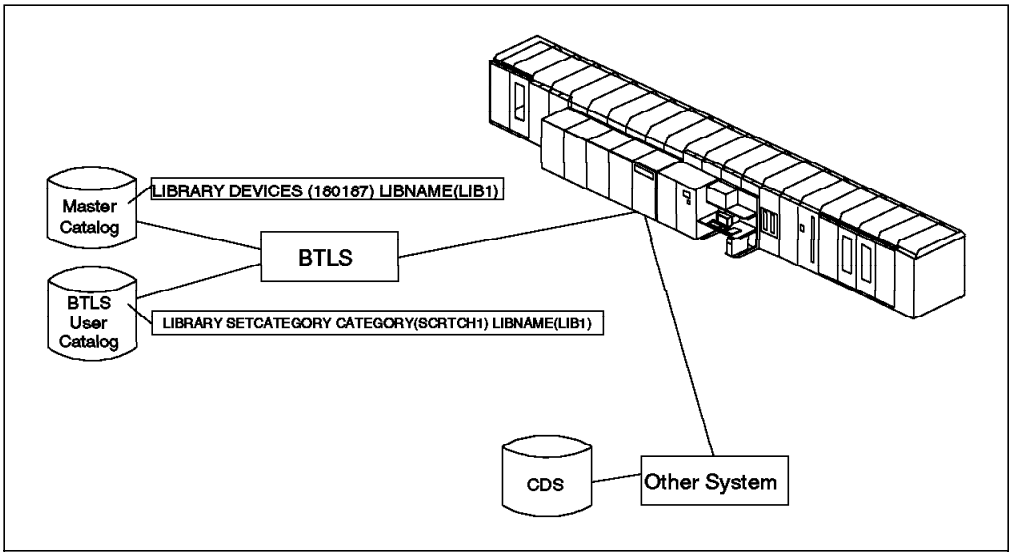

Figure 58. Partitioning between a BTLS System and Another System

6.2.2.1 Volume Assignment

For a scratch mount, use only the Library Manager volume category for a mount request to the IBM Automated Tape Library. To partition scratch volumes in the IBM Automated Tape Library, you must use a different Library Manager volume category for each system. The relationship between the Library Manager volume category (for example, X′0FFF′, X′FFFF′) and the system volume category (for example, SCRTCH1, PRIVATE) is shown in Appendix A, “Library Manager Volume Categories” on page 177.

In a BTLS environment, you can use only those volumes that are defined in the BTLS user catalog. To partition the private volumes between a BTLS system and another system, you have to define the BTLS-owned volumes to the BTLS system, and different volumes to the other system. We recommend that you use a different range of volume serial numbers to partition volumes among multiple systems.

6.2.2.2 Drive Assignment

One tape drive can be used by only one host system at a time. To partition an IBM Automated Tape Library, you must assign one set of tape drives in the IBM Automated Tape Library to the BTLS and a different set of tape drives to the other system.

The BTLS system can use only those tape drives that are defined by the AMS command, LIBRARY DEVICES. You can define one set of tape drives for one BTLS system to prevent the use of tape drives assigned to the other system. You must create esoteric device group names for the library devices to facilitate allocation to the IBM Automated Tape Library.

To reassign tape drives to another system, the same considerations apply as discussed in 4.3.2, “Drive Assignment and Cartridge Loading” on page 73.

6.3 Sharing

In this section we explain implementation considerations for sharing an IBM Automated Tape Library among multiple BTLS systems. We explain the general considerations for sharing an IBM Automated Tape Library in Chapter 4, “Multisystem Access” on page 63.

To share an IBM Automated Tape Library, all attached host systems must have access to the host control data sets in order to have identical library, drive, volume, and BTLS option information. In a BTLS system, this control data resides in the BTLS user catalog and in the host master catalog. The BTLS user catalog can be shared with (connected to) other MVS systems, and the host master catalog entries can be recreated in the master catalogs of other MVS systems. But only a BTLS system can use the information within these control data sets to control the IBM Automated Tape Library. As a result, a BTLS system cannot share an IBM Automated Tape Library with any system other than a BTLS system.

Figure 59 shows the sharing of an IBM Automated Tape Library among multiple BTLS systems.

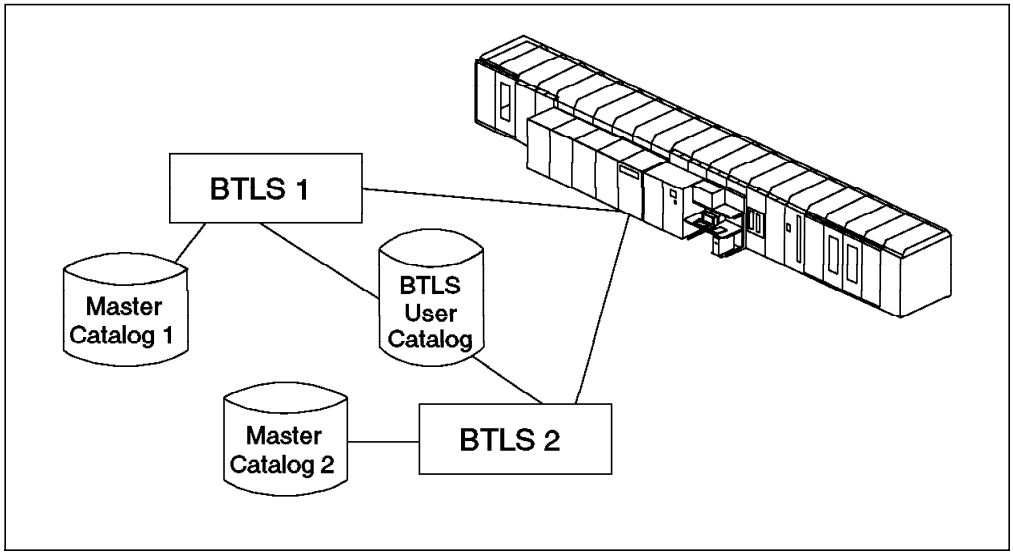

Figure 59. Sharing among Multiple BTLS Systems

6.3.1 Sharing Volumes among Multiple BTLS Systems

Sharing volumes in an IBM Automated Tape Library requires that all attached BTLS systems share the BTLS user catalog.

6.3.2 Sharing Drives among Multiple BTLS Systems

In a JES2 environment of releases earlier than MVS/ESA Version 5 Release 2, it is not possible to share tape drives. So one tape drive can be used by only one host system at a time. In an MVS/JES3 environment, you can share tape drives that reside in an IBM Automated Tape Library.

To reassign tape drives to another system, the same considerations apply as discussed in 4.3.2, “Drive Assignment and Cartridge Loading” on page 73.

6.4 Volume Transfer

Although you are partitioning an IBM Automated Tape Library, you might want to access a private volume for read-only purposes from a system other than the system originally owning the volume. In such cases, you have to transfer the volume from the system originally owning it to another system.

6.4.1 From One BTLS System to Another BTLS System

To transfer a volume from one BTLS system (BTLS1) to another (BTLS2), you must remove the volume from BTLS1 by using the AMS command, LIBRARY DELETE, and add it to BTLS2 by using the AMS command, LIBRARY DEFINE. From the Library Manager′s point of view, both BTLS systems use the same volume category (PRIVATE of BTLS). So you have to be careful when moving the volume record between two BTLS systems. Duplicate definitions of a volume will cause mount requests from different hosts for the same volume at a given point in time, if the systems are not in the same GRS ring.

6.4.2 From One BTLS System to Another System

To transfer a volume from one BTLS system to another system, you must remove the volume definition from the BTLS system and then eject the volume from the IBM Automated Tape Library by using the AMS command, LIBRARY SETCATEGORY, to set the Library Manager volume category XEJECT or XEJECTB to the volume. Then insert the volume into the IBM Automated Tape Library and perform the insert processing from the target system.

To avoid inconsistencies in the host system control data sets, define a volume in only one control data set.

6.5 Tape Management System Considerations

Tape management systems cannot interface with a BTLS system. When you install a tape management system, you have to define the volumes to both the tape management system and the BTLS system. To have both control data sets match, if the tape management system changes a volume′s status from PRIVATE to SCRTCH, you must use the AMS command, LIBRARY SETCATEGORY, to update the Library Manager volume category for the volume.

6.6 Recovery Considerations

BTLS uses catalog records to define a library configuration, allocation rules, and volumes that it handles. These catalog records reside in the master catalog and the BTLS user catalog.

The master catalog is important for both BTLS and MVS systems. If the master catalog fails, the MVS system is not available. To prevent master catalog failure, we recommend that the master catalog reside on the DASD volume that is defined as dual copy or belong to the RAMAC family. This will provide higher availability.

If the BTLS user catalog fails, you can obtain the list of the volumes by using the AMS command, LIBRARY INVENTORY, and then define the volumes to the new BTLS user catalog by using the AMS command, LIBRARY DEFINE. In this way, you can recover the BTLS user catalog definitions of volumes in the IBM Automated Tape Library.

When you use the AMS command, LIBRARY INVENTORY, to obtain the list of the volumes, the Library Manager will return a complete list of its inventory in response to this request. BTLS assigns its PRIVATE volumes to Library Manager volume category X′FFFF′. DFSMS/VM and VSE/ESA also use the same Library Manager volume category. In addition, AIX/6000 and the Control Path Server can use the user-specified Library Manager volume category. After you obtain the list of the PRIVATE category volumes, you must be careful to select BTLS volumes from the volume list. Therefore we recommend that you use a different range of volume serial numbers for each system.

The LIBRARY command functions AUDIT, LISTVOL and REPORT also enable you to get information about volumes and devices in your libraries.

Chapter 7. Implementation in a DFSMS/VM Environment

In this chapter we describe the basics of implementing DFSMS/VM RMS and explain how to partition and share IBM Automated Tape Library between DFSMS/VM RMS and other systems. We describe volume transfer to and from DFSMS/VM RMS and cover partitioning and sharing considerations for the VGS and foreign-host server support. Sections on tape management systems and recovery considerations are included.

7.1 Basics of DFSMS/VM RMS Implementation

In this section we outline the steps to install DFSMS/VM RMS. The *VM/ESA DFSMS/VM FL221 Removable Media Services User's Guide and Reference* contains a more detailed description.

7.1.1 Installation Steps

To install DFSMS/VM RMS:

1. Authorize RMSMASTR to interact with the IBM Automated Tape Library by adding the STDEVOPT control card to its CP directory entry. See Figure 60.

```
STDEVOPT LIBRARY CTL
```

Figure 60. Sample STDEVOPT Control Statement for RMSMASTR

2. Tailor the DFSMS/VM control file and RMS configuration file. These are described in 7.1.2, "Control Data Sets."
3. We recommend implementing the use of standard labels for all volumes. A standard label is an internal volume label, and the first file on a volume. Use of this internal label enables your tape management system to enforce better security by ensuring that both the internal and external volume labels match.
4. Authorize users to use the DFSMS/VM RMS functions through any one of the following:
   - RACF/VM
   - The DFSMS/VM authorization file
   - Installation-defined authorization using the DFSMS/VM RMS exit FSMVAUTH.

7.1.2 Control Data Sets

In this section we describe the data sets used in the DFSMS/VM RMS environment and the parameters that you need to use to implement sharing or partitioning.

- *IBM Automated Tape Library Dataservers and default scratch category—DGTVCNTL DATA*

  In the DFSMS/VM DGTVCNTL DATA control file, using the RM_AUTO_LIBRARY parameter, define the name and sequence number (the five digits of the IBM Automated Tape Library's serial number) of every IBM Automated Tape Library you use. DGTVCNTL DATA is kept in the SFS VMSYS:DFSMS.CONTROL directory.

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Optionally you can define the default scratch pool to be used when the SCRATCH category is specified by using the RM_DEFAULT_SCRATCH_POOL parameter in the DGTVCNTL DATA control file.

- *Other parameters in DGTVCNTL DATA*

  You must specify the name of the RMSMASTR machine by using DFSMSRM_MASTER_VM and the name of the global APPC resource by which your DFSMS/VM system is known by using GLOBAL_RESOURCE_ID. All other variables are optional.

  If you have a foreign-host server machine or are using VSE/ESA as a guest of VM/ESA using the VGS support, you can set this server machine to be autologged during DFSMS/VM RMS initialization by using the FOREIGN_HOST_SERVER_VM parameter.

- *Tape drives—RMCONFIG DATA*

  To define which tape drives are available to DFSMS/VM RMS inside the IBM Automated Tape Librarys, you must use the RMCONFIG DATA configuration file. This file is kept in the SFS VMSYS:DFSMS.CONTROL directory. You must restart the DFSMS/VM RMS machine if you change this file.

- *Automatic-insert bulk processing files—RMBnnnnn DATA*

  DFSMS/VM RMS does automatic-insert bulk processing if the RMBnnnnn DATA file or files are in the VMSYS:DFSMS.CONTROL directory. nnnnn matches up with the sequence number for an IBM Automated Tape Library defined in DGTVCNTL DATA. There is only one automatic-insert bulk processing file for each IBM Automated Tape Library.

- *On-request bulk processing files*

  You use on-request bulk processing files to do bulk changes of volume categories. The source category includes INSERT but not EJECT or EJECTB. The target category includes EJECT and EJECTB but not INSERT. You can do insert processing if you do not have automatic-insert bulk processing active for one or more IBM Automated Tape Librarys. You can use a bulk processing file on only one IBM Automated Tape Library at a time. You can choose to keep one file for each IBM Automated Tape Library or one file for all volumes.

  You can create as many on-request bulk processing files as you want and place them on any directory to which DFSMS/VM RMS has access. If more than one system tries to run insert processing by using the same volume list, the insert processing of the second system may be failed by the command reject. We do not recommend having two host systems handle insert processing for a specific bulk processing file.

  The FSMRMSHR exit is executed whenever on-request bulk processing is executed.

7.1.3 Exits

There are a number of installationwide exits that you can use. Their use is not compulsory. The exits are described in the *VM/ESA DFSMS/VM Function Level 221 Removable Media Services User's Guide and Reference*.

Below describe the use of the following exits:

- FSMRMSHR—DFSMS/VM RMS library partitioning
- FSMVAUTH—authorization checking

- FSMRMDEV—real device selection
- FSMRMATE—device attachment
- FSMRMPRE—DFSMS/VM RMS preprocessing.

7.1.3.1 FSMRMSHR

If you are sharing or partitioning an IBM Automated Tape Library you should use the FSMRMSHR exit to control which volumes, categories, and libraries can be used whenever you use:

- DFSMSRM MOUNT
- DFSMSRM SET VOLCAT
- DFSMSRM SET DEVCAT
- Bulk processing—both automatic-insert and on-request.

The parameters passed to the FSMRMSHR exit include the volume name, the source and target category names for the volume or scratch pool, and the IBM Automated Tape Library name. You can modify the exit to define which volumes, categories, and IBM Automated Tape Library names can be used for this DFSMS/VM RMS and to reject any invalid requests. In this way you can deny access to unauthorized volumes, categories, and IBM Automated Tape Library.

For an example of modifying the FSMRMSHR exit, see Chapter 4 of *Lights Out! Advanced Tape Automation Using VM/ESA*. In that example, a file, called FSMRMSHR CTLDATA, is used to define which volumes, categories, and IBM Automated Tape Librarys can be used. You must consider how you want to maintain such a file and whether you would want to share it among multiple DFSMS/VM RMS systems.

You could use the FSMRMSHR exit to ensure that particular volume numbers are never used with a particular IBM Automated Tape Library. For example, you can deny access to a volume number 111111 in the IBM Automated Tape Library.

Note that the FSMRMSHR exit does not allow you to determine who the original requester is, so the same criteria apply to all of the requests that this DFSMS/VM RMS processes. For example, if you code your FSMRMSHR exit in this DFSMS/VM RMS machine so that the SCRATCH4 scratch category cannot be used, no request to this DFSMS/VM RMS machine will be able to use SCRATCH4. You might want to do something like this to control scratch pool access among multiple VM/ESA hosts.

7.1.3.2 FSMVAUTH

If you want to restrict the DFSMS/VM RMS services that a requester can use, you must use RACF/VM or DFSMS/VM′s own authorization exit, FSMVAUTH. You also use this exit to validate that the requester is authorized to use DFSMS/VM RMS.

7.1.3.3 FSMRMDEV

The real-device-selection exit, FSMRMDEV, can select a device when a real device address is not specified in the incoming request. Users can provide their own device selection algorithm. The product default processing selects the first available (unattached) library tape device that can be located. The request fails if no devices are available.

Note: This exit becomes highly interesting in an environment of mixed drive types where getting the correct media-drive match is critical. A

sophisticated exit may be required here, to match a selected device type to a particular scratch pool being requested, or a volume serial number within a customer-defined range that represents a certain media type.

7.1.3.4 FSMRMATE

The device-attachment exit, FSMRMATE, allows your installation to substitute your own command for attaching the requested or selected device.

7.1.3.5 FSMRMPRE

FSMRMPRE is called before the actual command request to the IBM Automated Tape Library hardware takes place and after the FSMVAUTH and FSMRMSHR exits have been processed. This exit can be used to provide object-level security checking if a tape management system does not supply such checking.

For example, if you want to ensure that a VSE/ESA guest using the VGS service machine is using the correct volumes, you need to modify the FSMRMPRE preprocessing exit. Beforehand you can use FSMVAUTH and FSMRMSHR to verify that VGS is authorized to issue the requests it has made and to ensure that mounts are being requested for volumes and scratch categories that this VSE/ESA guest can use, using VGS. Using FSMRMPRE you can ensure that all VGS requests are valid with respect to external volume labels. Other parameters are also passed to this exit. These are listed in the *VM/ESA DFSMS/VM FL221 Removable Media Services User's Guide and Reference*.

7.1.4 Insert Processing

DFSMS/VM can do insert processing in three ways:

- Automatic-insert bulk processing, which DFSMS/VM RMS uses if the RMBnnnnn DATA file exists.
- On-request bulk processing using the BULK option of the DFSMS/VM RMS command, DFSMSRM SET VOLCAT, and giving the name of the bulk processing file to be used.
- By specific request.

All insert processing causes the FSMRMSHR exit to be executed.

Please note that automatic-insert bulk processing does not immediately occur when a volume is put into the input station. Because RMSMASTR cannot receive unsolicited interruptions of cartridge insertion without a tape drive attached, RMSMASTR periodically queries the INSERT category to find out if there are volumes in it.

Automatic-insert bulk processing occurs when the INSERT category is not empty and:

- RMSMASTR is initially started.
- RMSMASTR is restarted.
- RMSMASTR receives a valid MOUNT command.
- RMSMASTR receives a valid SET DEVCAT command.

In the last two cases, automatic-insert bulk processing is totally independent of the actual command issued, but the command must be valid.

Automatic-insert bulk processing uses another tape device that RMSMASTR selects. If an unused tape device is not available at the time insert processing starts, processing will not continue. Because the insert processing will most

likely start before the MOUNT (or SET DEVCAT) finishes with its tape device, another must be available. If this is not the case, the user can move volumes from the INSERT category to the category of choice by using the SET VOLCAT BULK command.

7.1.5 Scratch Categories

You will most likely have one scratch category for each media type. Your tape management system should control the movement of volumes into each scratch category according to the volume′s characteristics, as DFSMS/VM RMS does not track these characteristics. As we have already emphasized, getting the correct media-drive match is very important. The Library Manager does not care if you put IBM 3490 and 3590 tape volumes in the same scratch pool; it will do as you request. You could use the FSMRMPRE user exit to ensure that only the volume serial numbers in specified ranges are put in the designated scratch categories.

7.2 Partitioning

In this section we describe partitioning drives and volumes between a DFSMS/VM RMS and another system.

7.2.1 Tape Drives

You define in the DFSMS/VM RMS control files, DGTVCNTL DATA and RMCONFIG DATA, the IBM Automated Tape Librarys and tape drives that DFSMS/VM RMS can use. All tape drives that are varied on to the VM/ESA system are available for DFSMS/VM RMS to use. If you VARY OFF any of those tape drives, they will not be available to DFSMS/VM RMS or any other user of that VM/ESA system. In this way you ensure that the IBM Automated Tape Librarys and tape drives that DFSMS/VM RMS uses are confined to a subset of the devices available, and in this way you partition the drives. You will need to ensure that all other systems using the same IBM Automated Tape Librarys do not have access to the tape drives that DFSMS/VM RMS is using to achieve partitioning.

7.2.2 Volumes

It is possible to partition the volumes in an IBM Automated Tape Library using DFSMS/VM RMS such that each DFSMS/VM RMS can only access a specified group of volumes and specific scratch categories.

To limit which volumes and scratch categories the DFSMS/VM RMS system can use you must use the FSMRMSHR exit, which is described in 7.1.3, “Exits” on page 128.

7.2.2.1 Private Volumes

If you are partitioning volumes with any other systems, you must ensure that those systems also have mechanisms to prevent them from using the volumes that the DFSMS/VM RMS system “owns.” It is always possible for any system using the same IBM Automated Tape Library to access any volume in the IBM Automated Tape Library by specifying the external volume label. You must protect against this on all systems by ensuring that they cannot issue any commands against volumes that do not belong to them.

7.2.2.2 Scratch Categories

If you are partitioning volumes of a DFSMS/VM RMS system with other DFSMS/VM RMS systems or any AIX/6000 or ADSM/6000 systems, you must partition scratch categories. If other DFSMS/VM RMS systems are using the same IBM Automated Tape Librarys, you can ensure that you partition the scratch categories to be used by using the FSMRMSHR exit on each DFSMS/VM RMS system. You can set the default scratch category to be different on each DFSMS/VM RMS system by using the RM_DEFAULT_SCRATCH_POOL option in the DFSMS/VM configuration file. The partitioning of scratch categories may prove to be a practical limitation on how many DFSMS/VM RMS systems can partition a single IBM Automated Tape Library, as each DFSMS/VM RMS system will need at least one scratch category of the 16 available.

If your DFSMS/VM RMS system is partitioning the IBM Automated Tape Library with an AIX/6000 system, you must ensure that it does not have access to the Library Manager categories represented by SCRATCHx to DFSMS/VM RMS. Table 17 on page 177 lists the hexadecimal categories that DFSMS/VM RMS uses for SCRATCHx.

7.3 Sharing

In this section we cover the sharing of tape drives and volumes between DFSMS/VM RMS and other systems.

7.3.1 Tape Drives

In this section we cover how VM/ESA shares tape drives, how to share tape drives using DFSMS/VM RMS, and how to use DFSMS/VM RMS to ensure that the ICL/ACFs of shared tape drives are filled with the correct scratch category.

7.3.1.1 VM/ESA System and Any Other System

The considerations for sharing drives inside an IBM Automated Tape Library between a VM/ESA user (in our case, DFSMS/VM RMS) and another system are no different from sharing tape drives outside an IBM Automated Tape Library in terms of which system has access to the drives at any one time.

In this section, when we use the term *VM/ESA user* we exclude a guest operating system of VM. We refer to a guest operating system as a *VM/ESA guest*. Refer to Figure 61 on page 133 as you read the following explanation.

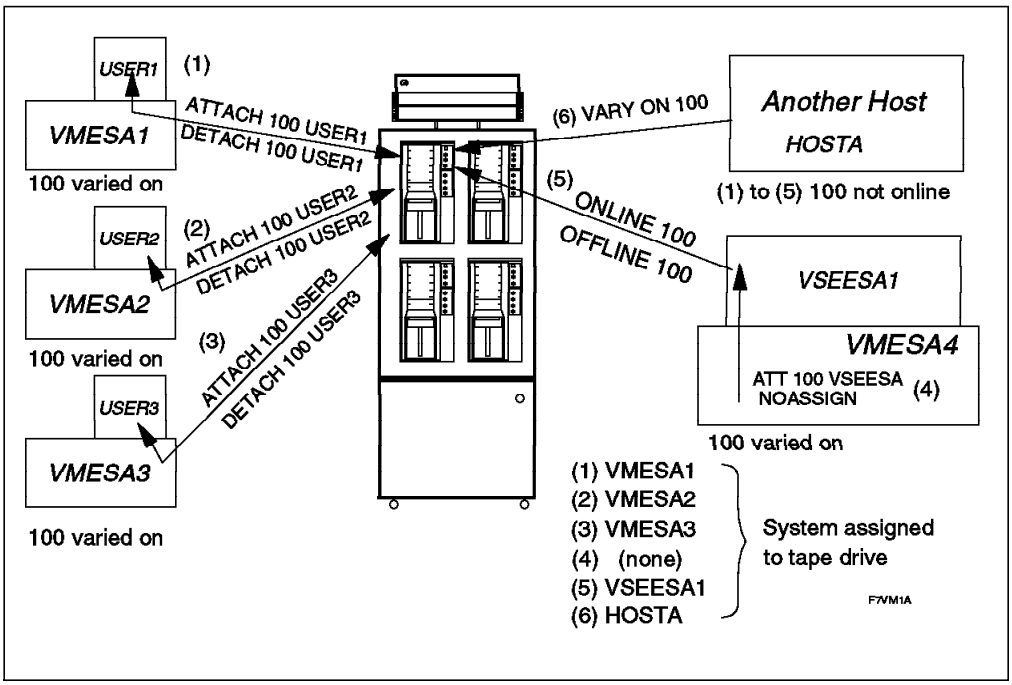

Figure 61. VM/ESA and Other Systems Sharing a Tape Drive

Tape drives can be shared serially among multiple VM/ESA users on multiple VM/ESA systems without requiring operator intervention, because the CP commands, ATTACH and DETACH, that cause the tape drive to be reserved and released can be issued from within a program. These CP commands normally issue the hardware channel command words (CCWs), ASSIGN and NOASSIGN, to a 3480, 3490, 3490E or 3590 to reserve or release the tape drive to or from the operating system. ATTACH and DETACH are used in events (1), (2) and (3) in Figure 61. The ASSIGN and UNASSIGN CCWs are specific to 3480, 3490, 3490E and 3590 hardware. The ASSIGN CCW places the operating system′s identifier in the tape drive hardware and prevents access by any other system.

Once a VM/ESA user has finished using a tape drive, it is usual to release it (using DETACH) such that it is immediately available to the next request from any system connected to it. In Figure 61, after event (1) has completed, the first command to reach the tape drive would assign it. This could be (2), (3), (5), or (6).

If the next operating system trying to access the tape drive is not a VM/ESA user but another operating system (either native or a VM/ESA guest), it makes the tape drive available for its use by using an operator console command or during its IPL. The tape drive is assigned and is then available to jobs running in that operating system only. However, when jobs complete, the tape drive is still assigned by that operating system as no unassign of the tape drive is usually done once the job finishes. In Figure 61, the system VSEESA1 can perform multiple jobs using the tape drive, but it is not until VSEESA1 issues the OFFLINE that the tape drive is available for another system, even if the tape drive is idle.

An exception to this is AIX/6000, where the assign is issued separately from commands that make the tape drive available.

This explanation does not cover all possible options, only the most common situation. One difference might be in the use of the CP ATTACH command,

which a VM/ESA user could use with the NOASSIGN option. This option is typically used when attaching a tape drive to a VM/ESA guest (which allows the VM/ESA guest to issue its own command to reserve the tape drive); it is typically used by a VM/ESA user. We have shown this as event (4) in Figure 61 on page 133. At this point the tape drive is not reserved by any of the systems. Should event (5) not occur, event (6) would reserve the tape drive for HOSTA.

7.3.1.2 DFSMS/VM RMS

A request to DFSMS/VM RMS can be made either with the address of a tape drive already attached to the requester, or without, in which case DFSMS/VM RMS attempts to locate a tape drive to fulfill the request. All tape drives that DFSMS/VM RMS may use are defined in the RMCONFIG DATA file. For DFSMS/VM RMS requests that do not use the NOASSIGN or NOATTACH options, the issues of using an IBM Automated Tape Library with shared tape drives are no different from sharing tape drives without using an IBM Automated Tape Library. These issues are whether the shared tape drives are assigned to other systems but not in use, which will mean that DFSMS/VM RMS cannot use them, and the loading of ICL/ACFs with appropriate scratch volumes.

7.3.1.3 ICL/ACF Loading

If you are sharing a tape drive in an IBM 3495 and the tape drive has an ICL/ACF, you may want to ensure that you fill the ICL/ACF with a scratch category that your DFSMS/VM RMS system can use. To do this, you need to issue a DFSMSRM SET DEVCAT command before the MOUNT command. You must consider carefully when and whether to do this, as the refilling of the ICL/ACF can take longer than the benefit you get from using the ICL/ACF for scratch mounts.

7.3.2 Volumes

DFSMS/VM RMS does not keep any catalog or file of volumes that it “owns.” The sharing of volumes for a DFSMS/VM RMS system is thus limited to how you might make a volume known to another system, and how you might share scratch categories. To have a common pool of information about the volumes in an IBM Automated Tape Library between a DFSMS/VM RMS system and another is not within the scope of DFSMS/VM RMS, but might be possible using a tape management system. Some tape management systems may have facilities that allow the sharing of their inventories between two or more systems.

As with sharing volumes between systems in any situation, you must ensure that you have a common data format that both systems can understand.

7.3.2.1 Scratch Volumes

DFSMS/VM RMS can share a scratch category with any other DFSMS/VM RMS system by using the same SCRATCHx category name.

DFSMS/VM RMS can only share scratch volumes with AIX/6000 systems if they define their scratch categories to be the same as those that DFSMS/VM RMS uses. This is the converse of the point made in 7.2.2, “Volumes” on page 131.

7.3.2.2 Private Volumes

Multiple systems can mount private volumes (VOLspecific) of a VM/ESA system in an IBM Automated Tape Library if they know the external volume labels.

Equally, if VM/ESA users know the external label of any volume in the IBM Automated Tape Library, they can request DFSMS/VM RMS to mount it.

To share volumes you need a mechanism to tell the second system the external volume label of the volume to be shared, the IBM Automated Tape Library in which it resides, and what it contains. There are no standard methods of doing this. Your tape management system on VM/ESA may have facilities to help you.

The sharing of private volumes should be done with caution. You must put in place good security measures in every system sharing the IBM Automated Tape Library to ensure that only those volumes that you want to be shared are shared. It is assumed that, within the DFSMS/VM RMS system itself and the tape management system, such security mechanisms have been implemented.

7.4 Volume Transfer

DFSMS/VM RMS can also transfer volumes to another system. DFSMS/VM RMS itself keeps no record of the external volume labels it has in any IBM Automated Tape Library, although you can have bulk processing files that can include the external volume label of the volume to be transferred.

To do the transfer:

- Remove the external volume label from any records that a tape management system might have.
- Alter the contents of any bulk processing files so that they cannot process the transferred volume.
- Update any files you have created to use the FSMRMSHR exit.
- Update the appropriate records on the new system.

If the second system cannot share the volume because its Library Manager hexadecimal category does not match any of those of DFSMS/VM RMS (for example, OS/400), volume transfer cannot occur directly between the two systems. In such a case, you have to change the volume category to the appropriate volume category that the receiving system handles.

If there is a third system sharing the same IBM Automated Tape Library that has common Library Manager hexadecimal categories with both the original volume owner and the new volume owner, it can act as an intermediary. It is possible to transfer the volume within the IBM Automated Tape Library without changing it by transferring the volume to this third, intermediary system, letting this system change its category and then transferring it to the new volume owner. AIX/6000, with its ability to use any Library Manager hexadecimal category, is the only system that could be set up as an intermediary system.

7.5 Guest Support

If you have a guest of VM/ESA, for example, MVS/ESA or VSE/ESA with LCDD, it will have its own means of communicating with the IBM Automated Tape Library and for operational purposes can be considered to be entirely independent. The only difference is that VM/ESA will need to have tape drives varied online to it in order for the guest to be able to use it.

7.6 VSE Guest Server Considerations

In this section we describe the specifics of using VGS including implementation, exits, and special considerations for sharing and partitioning. Figure 62 shows an overall picture of VSE Guest support.

Note: Remember that some vendor tape management support scenarios do not use VGS.

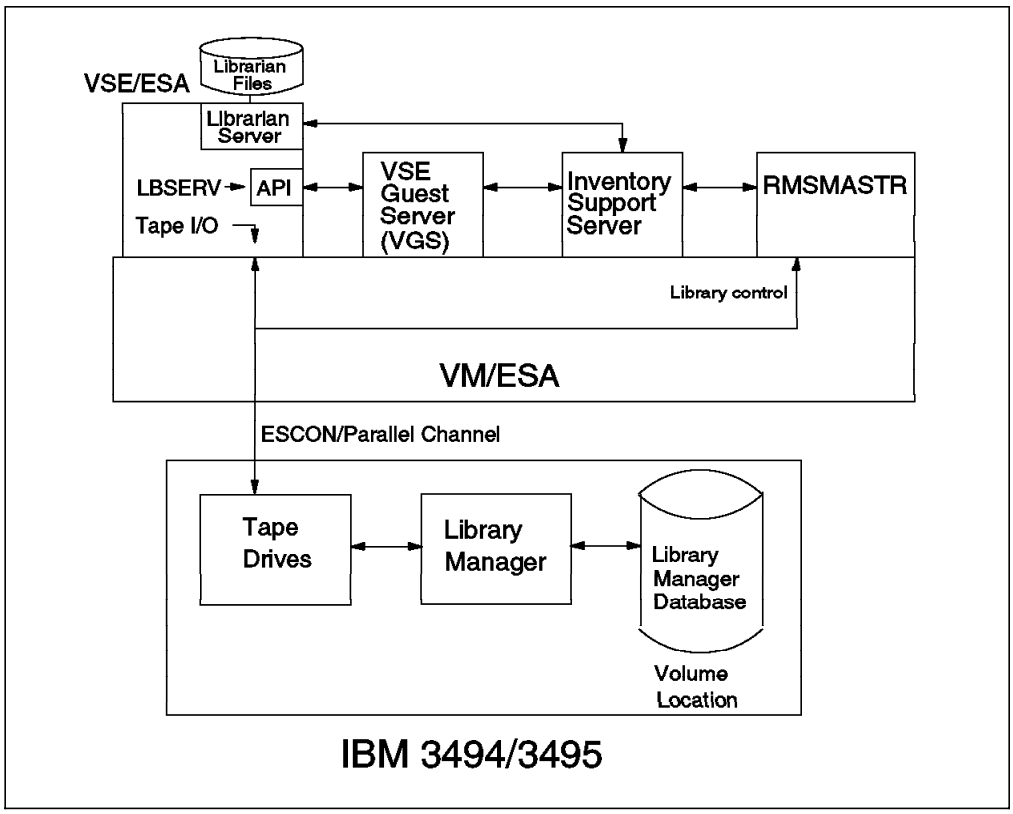

Figure 62. VSE Guest Support on VM/ESA

7.6.1 Implementation

Before installing VGS, you must make sure that the following programming requirements are satisfied:

- VM/ESA Version 1 Release 2.0 or higher
- DFSMS/VM Function Level 221
- For VGS, DFSMS/VM PTFs associated with APARs VM58436 and VM58787
- For LBSERV API, VSE/ESA PTFs associated with APAR DY43306 on top of VSE/ESA Version 1.3.5, or higher releases of VSE/ESA.

Please ensure that you check for, and apply, any additional relevant PTFs.

You may install two VGS service machines on VM/ESA and set up the VSE/ESA Librarian server for CMS users on the VSE/ESA guest machine. We call a primary VGS service machine a VGS, and a secondary service machine an Inventory Support Server.

VGS can be used without an Inventory Support Server if inventory functions are not to be exploited.

7.6.1.1 VGS Service Machine

To install a primary VGS machine you must do the following:

- Define the VGS machine in the CP directory. It should have privilege class B for attaching and detaching tape devices. It must have an appropriate IUCV *IDENT statement to enable it to communicate with the VSE/ESA API as the manager of a local APPC/VM resource named VGLIBSRV. Figure 63 shows a sample CP directory entry for VGS.

```
USER VGLIBSRV XXXXXXX 32M 64M BG
*--------------------------------------------------------------------*
IPL CMS
IUCV ALLOW
IUCV *IDENT RESANY LOCAL
CONSOLE 01F 3215
SPOOL 00C 2540 READER B
SPOOL 00D 2540 PUNCH B
SPOOL 00E 1403 A
MDISK 0191 3380 2620 5 MDISKA MR
```

Figure 63. Sample CP Directory Entry for VGS

- Include in the PROFILE EXEC of VGS the following to allow it to function as a server using Common Programming Interface (CPI) Communications:
  - SET SERVER ON
  - SET FULLSCREEN ON
  - SET ATUOREAD OFF.

  Figure 64 on page 138 shows a sample PROFILE EXEC for VGS.

```
/*  === PROFILE EXEC for VGS Service Machine ===      */
TERM MORE 1 1 HOLD OFF
'CP SPOOL CONS START'
'CP SPOOL READER HOLD'
'CP SET RUN ON'
SET EMSG ON
SET IMSG ON
SET SMSG ON
/* Needed for CPIC server     */
'SET SERVER ON'
'SET FULLSCREEN OFF'
'SET AUTOREAD OFF'
/* Make DFSMS CSLLIB routines available */
'CP LINK DFSMS 1B5 1B5 RR'
'ACCESS 1B5 B'
'RTNLOAD * (FROM FSMPPSI'
'FSMRMVGS'
Exit rc
```

Figure 64. Sample VGS PROFILE EXEC

- Ensure that VGS has access to the DFSMS/VM product code and authorization to use it.
- Ensure that VGS has its own R/W 191 minidisk.

  VGS maintains CMS files with in-process and completed work on a CMS minidisk. The size of these completed-work files and, in turn, the number of cylinders required for this minidisk, can be controlled through a customization option that specifies the amount of time request history data should be kept on file. Other small, temporary files are kept on this disk. VGS accesses its 191 minidisk as file mode A.
- Ensure read access to Inventory Support Server's 191 minidisk

  VGS and the secondary server required for inventory functions need to access each other's 191 minidisk for read. Each links the other server's 191 as 292 and accesses it as file mode C inside the application code. Thus, the LINK and ACCESS statements are not reflected in the sample PROFILE EXEC. This authorization may be accomplished through a security or directory product.
- VGS can be autologged at DFSMS/VM RMS initialization by using it with the FOREIGN_HOST_SERVER_VM parameter in the DGTVCNTL DATA control file. Any other technique of logging on VGS is acceptable.

7.6.1.2 Inventory Support Server Service Machine

Figure 65 on page 139 shows a sample CP directory entry for the Inventory Support Server as a secondary VGS and Figure 66 on page 139 shows the PROFILE EXEC.

```
USER VGINVHLP XXXXXXX 32M 64M G
XAUTOLOG VGLIBSRV
*-------------------------------------------------------*
IPL CMS
IUCV ALLOW
IUCV *IDENT RESANY LOCAL
CONSOLE 01F 3215
SPOOL 00C 2540 READER B
SPOOL 00D 2540 PUNCH B
SPOOL 00E 1403 A
MDISK 0191 3380 636 5 MDISK6 MR
```

Figure 65. Sample CP Directory Entry for Inventory Support Server

```
/*   === PROFILE EXEC for Inventory Support Server ===     */
TERM MORE 1 1 HOLD OFF
'CP SPOOL CONS START'
'CP SPOOL READER HOLD'
'CP SET RUN ON'
SET EMSG ON
SET IMSG ON
SET SMSG ON
/* Make DFSMS CSLLIB routines available */
'CP LINK DFSMS 1B5 1B5 RR'
'ACCESS 1B5 B'
'RTNLOAD * (FROM FSMPPSI'
'FSMRMVGH'
Exit
```

Figure 66. Sample Inventory Support Server PROFILE EXEC

The following items are of special interest in defining the Inventory Support Server service machine in the CP directory and/or creating its PROFILE EXEC:

- Intermachine communication

  This machine communicates with the VSE/ESA Librarian Server for CMS users to obtain and replace inventory files. The Inventory Support Server service machine thus needs the following IUCV statements in its directory entry:

  - IUCV ALLOW
  - IUCV *IDENT RESANY GLOBAL.

- Access to DFSMS product code

  This machine uses the command and CSL interfaces provided in DFSMS/VM to request library functions from the DFSMS/VM RMS. Thus, the Inventory Support Server service machine must be authorized to request DFSMS/VM RMS functions, and it needs access to the DFSMS/VM product disk. Typically, routines in CSL library FSMPPSI are loaded by the machine's PROFILE EXEC.

- R/W 191 minidisk

  The Inventory Support Server keeps interim files for requests in process on its 191 disk.

- Read-access to VGS's 191 minidisk

- XAUTOLOG by VGS

  The default technique for starting the Inventory Support Server is that VGS XAUTOLOGs it during initialization. Unless local conventions do not permit this XAUTOLOG procedure, the XAUTOLOG statement can be used in this machine's directory entry to authorize VGS to autolog it.

The Inventory Support Server service machine can be started by any of the following techniques:

- Allowing the VGS machine to AUTOLOG it during VGS initialization
- Standard operational protocols used by the installation for autologging service machines
- Logging on manually, starting the main EXEC, FSMRMVGC, and then disconnecting the machine (#CP DISC).

An orderly sequencing down of this machine with VGS is important. The machine needs to restart whenever VGS restarts. (The converse is not true; VGS does not need to restart if the Inventory Support Server restarts.) To ensure that restart is properly serialized, the following measures are taken:

1. VGS attempts to AUTOLOG the Inventory Support Server machine during VGS startup; if the secondary machine is already logged on, VGS sends the secondary machine a restart order. This ensures that the machines are synchronized in terms of in-process requests.
2. As part of its orderly termination processing, VGS sends the secondary machine a shutdown request. The secondary machine ends its processing EXEC.

7.6.1.3 Librarian Server for CMS Users

To enable VSE/ESA guest exploitation of inventory support functions through LBSERV-VGS interfaces. The following parts, which can be requested from an internal marketing tools repository, are available from your IBM representative:

- LIBRCMS MODULE—CMS support code to request VSE/ESA Librarian functions for a CMS user
- LIBRCMSI JCL—Job stream to catalog the VSE/ESA Librarian server on VSE/ESA
- LIBRCMS JCL—Sample JCL to start the Librarian Server on VSE/ESA.

The LIBRCMS module is installed on the DFSMS/VM product disk along with other parts related to VGS. The LIBRCMS functions are thereby accessible to the Inventory Support Server service machine. No further activity is required for the CMS side.

LIBRCMSI JCL is installed on the DFSMS/VM product disk during install processing. Send this job to each VSE/ESA guest that is to request IBM Automated Tape Library support through VGS. This job catalogs the unique LIBRCMSV phase to PDR2.COMM.

On VSE/ESA, a free partition of 1 MB minimum size is required for running the Librarian Server. A dynamic partition may be used. At least 50 KB should be allocated by means of the SETPFIX JCL command to fix pages needed for APPC/VM communication with the Inventory Support Server.

Note:

1. APPC/VM definitions are not required when IPLing VSE/ESA (SET XPCC commands).
2. LIBRCMS must **not** be defined by SET XPCC TARGET at IPL time.

Remember that you must edit a LIBRCMS SRVNAMES cross-reference file on the Inventory Support Server service machine's 191 minidisk if VGS is to service inventory requests for multiple VSE/ESA guests. The SRVNAME specified in the SETPARM statement must be unique for each VSE/ESA guest.

7.6.2 Exits

There are two exits, FSMRMVGC EXEC and FSMRMVGA EXEC, on the A-disk of the VGS service machine. Customization of these is optional.

FSMRMVGC EXEC allows additional customization of VGS. The SCRTCH_POOL control field determines which DFSMS/VM RMS scratch category is to be used when a MOUNT volume request specifies SCRTCH as the volume serial. The default is the DFSMS/VM RMS SCRATCH0 category.

FSMRMVGA EXEC allows authorization checking to determine the validity of the userid of the requester, an eight-character control-block identifier in the request and the request type.

7.6.3 Files

The LIBCONFG LIST file must be present on the VGS service machine's A-disk if more than one IBM Automated Tape Library is to be used. You should code in here the name of the IBM Automated Tape Library for VSE/ESA and the DFSMS/VM library name. This file simply cross-references the VSE/ESA guest's library names (up to 8 characters) with the library names (up to 32 characters) that DFSMS/VM uses. For an example, see Figure 67.

```
* Configuration file last updated by Fliss on October 31, 1994
L10134   AUTO_LIB_1
L10137   AUTO_LIB_2
L50045   AUTO_LIB_3
* end of configuration data
```

Figure 67. Sample LIBCONFG LIST File

If the VGS resource is to handle library control successfully for multiple VSE/ESA guests that issue inventory requests, a LIBRCMS SRVNAMES file must be present on the Inventory Support Server service machine's 191 minidisk. This file simply cross-references the userid (up to eight characters) of the VSE/ESA guest with the "server name" (up to eight characters) specified in the LIBRCMS // SETPARM SRVNAME job control card on that guest. This cross-reference file enables the Inventory Support Server to access Librarian files on the correct VSE guest machine. Valid records (lines) in this file have two fields, separated by at least one blank character:

- VSE guest userid
- LIBRCMS server name.

For an example, see Figure 68 on page 142.

```
* LIBRCMS xref file last updated by Kathy on October 31, 1994
VSE1   LIBRC1
VSE2   LIBRC2
VSE3   LIBRC3
* end of cross-reference data
```

Figure 68. Sample LIBRCMS SRVNAMES File

7.6.4 Usage

The interface from VSE/ESA to VGS is through the new macro, LBSERV. The LBSERV API and the LIBSERV AR and JCL statements are the same as that used by the LCDD for VSE/ESA. The following VGS services are provided by the LBSERV API:

- Query a volume, checking a single library.
- Query a volume, checking all attached libraries.
- Query a category count.
- Query the IBM Automated Tape Library status.
- Query status of a tape drive inside library.
- Mount a specific volume.
- Mount a volume from a category.
- Eject a volume.
- Set a volume category.
- Query the inventory.
- Manage the inventory.
- Release a drive.
- Cancel a mount.

The last two LBSERV functions (release a drive and cancel a mount) do not require interaction with the Library Manager in an IBM Automated Tape Library.

An interface for explicit demount is intentionally not provided. Demount operations are automatically queued by the library at rewind-unload time.

VGS does not have an insert processing capability. All insert processing is handled by DFSMS/VM RMS.

VSE/ESA's scratch pool volume category names (SCRATCH00 through SCRATCH15) can be used in a VGS environment, but they are mapped to a physical RMS scratch pool (SCRATCH0 to SCRATCHF).

7.6.5 Partitioning

You can dedicate tape drives to the guest VSE/ESA system in the partitioned IBM Automated Tape Library. The VGS service machine has no tape drives of its own to use. Once the VSE/ESA guest has issued the ONLINE command, which issues the ASSIGN CCW to a tape drive, no other system accessing the same IBM Automated Tape Library can access that tape drive.

To partition the volumes to be used by a VSE/ESA guest using VGS, you will need to use the FSMRMPRE preprocessing exit of DFSMS/VM RMS. Using this exit will allow you to ensure that VGS not only requests volumes that this DFSMS/VM RMS can access but also accesses only the volumes you determine it can access.

If you are using DFSMS/VM RMS for multiple requesters such as a VSE/ESA guest using VGS and other VM users, you can guarantee the partitioning of volumes between the various DFSMS/VM RMS requesters by using the FSMRMPRE exit.

7.6.6 Sharing Tape Drives

A VSE/ESA guest using VGS that is sharing tape drives with other systems using the same IBM Automated Tape Library can share tape drives with other DFSMS/VM RMS users and other IBM Automated Tape Library users. You could use a system such as BRUNOGTA, which is described in 7.7, “Tape Management System Considerations,” to manage a pool of tape drives.

There is no mechanism within VGS to manage the sharing of tape drives with any other system using the IBM Automated Tape Library. The vendor tape managers have capabilities to allow sharing drives among VSE hosts.

Volume sharing is possible with any system using the IBM Automated Tape Library if the external volume label is known to the VSE/ESA guest.

7.6.7 Volume Transfer

Volume transfer must be done by DFSMS/VM RMS. There is no support within VGS to allow the category of a volume to be changed apart from EJECTing the volume from the IBM Automated Tape Library.

7.7 Tape Management System Considerations

DFSMS/VM RMS is written on the assumption that you most likely also have a tape management system in place. IBM does not have a tape management system for VM/ESA environment.

The *Lights Out! Advanced Tape Automation Using VM/ESA* manual describes a system called BRUNOGTA, developed by IBM Canada. BRUNOGTA is used to control both tape drive allocation between second-level guests and access to volumes. Its purpose is to maximize the use of tape drives so that a tape drive does not remain online to a guest when it is idle. It finds an available tape drive for any request and then passes it with the mount request to DFSMS/VM RMS. It removes, through VARY OFF, a tape drive from the control of a second-level guest if it has not been used within a time period of 180 seconds.

BRUNOGTA is available from your IBM representative as part of the BRUNOMNT PACKAGE, which can be requested from an internal marketing tools repository.

All other tape management systems will need some change in order to request services from DFSMS/VM RMS. Most tape management systems have exits that can be used for this purpose, but you must check with the tape management system product vendors to see whether their products can request services from DFSMS/VM RMS. When sharing or partitioning an IBM Automated Tape Library, you must ensure that volume and drive allocation is handled automatically. For example, you can no longer rely on a human operator who has a procedure that dictates that volumes with a red label must never be mounted on particular tape drives, even if the tape management system requests it. You must ensure that your tape management system permits only the amount of sharing that you want for your DFSMS/VM RMS system.

7.8 Recovery Considerations

You must keep copies of all files that DFSMS/VM RMS uses. There is no catalog of volumes that are under the control of DFSMS/VM RMS. The only records of potentially valid volume external labels for DFSMS/VM RMS are those kept for bulk processing purposes and any files kept for use with any exits. You must ensure that any tape management system you use has adequate recovery facilities in case of any loss of data. You can use the DFSMSRM Query LIBrary command to provide you with an inventory of volumes in an IBM Automated Tape Library (ALL, or SCRATCHx, or INSERT categories). Although you could process the resulting inventory to update your tape management system and recreate your bulk processing files if necessary, this is not a recommended recovery method. You should be aware that the inventory will include all the private volumes of all sharing systems that use the same Library Manager hexadecimal category of X′FFFF′ as DFSMS/VM RMS uses for its VOLspecific (private) volumes.

Chapter 8. Implementation in a VSE/ESA Environment

In this chapter, we describe the implementation of the LCDD for VSE/ESA and explain the factors to consider when sharing and partitioning an IBM Automated Tape Library among multiple systems.

8.1 Basic Implementation

In this section, we explain the basic implementation tasks of the LCDD for VSE/ESA. For detailed information about the installation tasks, see the *IBM 3494 Tape Library Dataserver User's Guide: Library Control Device Driver for VSE/ESA*.

Other documents detailing the VSE/ESA support for the IBM 3494 can be found in the IBM VSE/ESA home pages of the World Wide Web (WWW). The URL is:

`http://www.ibm.de/go/d00000166`

In the IBM VSE/ESA home page menu, please select "Documents, demos, and coding examples on an FTP server." You will get a menu "Resources available via FTP." In the menu, the following unclassified documents (ZIPed PostScript files) are offered to customers over an FTP server:

- vse3494s.zip, *VSE/ESA Support of the IBM 3494 Tape Library Dataserver* by *Gerhard Schneidt*, has a "VSE point of view." It describes, for example, VSE's IBM 3494 API and documents API reason codes.
- vse3494h.zip, *Native Support of the IBM 3494 Tape Library Dataserver with VSE/ESA* by *Friedrich Hahn* and *Joerg Haertel*, includes two customer scenarios for implementing an IBM 3494.
- 3494_vse.zip, *Support for the IBM 3494 Tape Library Dataserver in a VSE/ESA Environment* by *Kathy Eldred*, offers information about the IBM 3494.

8.1.1 Installation

The installation tasks are:

1. Select names for library control resources

   The LCDD application running in a VSE/ESA partition and the 3494 require resource names that are used in the LAN definition. These resource names are Local_VSE_ID and Library_ID.

2. Create the VTAM configuration

   LCDD is an LU6.2 application that communicates with the Library Manager of the 3494 through a Token-ring or Ethernet LAN. LCDD communication on a LAN requires appropriate VTAM definition on the VSE/ESA system.

3. Add an ATL SYS command to the IPL procedure

   A new VSE/ESA IPL command, SYS ATL=xxx, allows an ATL SYSCOM flag to be set as part of the IPL procedure. If the VSE/ESA system is running native (not on VM/ESA), SYS ATL=VSE is the default, and an explicit use of the statement is not required. However, if the LCDD of the VSE/ESA system is running on VM/ESA, the SYS ATL command statement is required in the IPL procedure. Refer to the *VSE/ESA System Control Statements* for details.

4. Define VSE/ESA libraries

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The following libraries should be defined on the VSE/ESA system for the code installation:

- LCA.PROD

  This is the target library for the LCDD product code during the installation process.

- Before starting the LCDD, a predefined Librarian library is also required where host copies of 3494 inventory lists are written. This library is used as output of Query Inventory (QI) processing and input of Managing the Inventory (MI) processing by the LCDD. The library name is specified by the Query_Inv_Lists and Manage_Inv_Lists parameters of the LCDD control statements.

5. Install LCDD code

   The LCDD product code and job control members must be installed in the VSE/ESA system, following the instructions for installing LCA.PROD in the *IBM 3494 Tape Library Dataserver User's Guide: Library Control Device Driver for VSE/ESA*.

6. Define LCDD options

   The LCDD expects certain installation-specific information to be provided by the user as control statements associated with the LCDD job. These control statements are read by the LCDD during its initialization processing. The control statements are:

   Local_VSE_ID an eight-character identifier for the VSE system

   Library_ID an eight-character LU name for an attached library and identification on the LAN network. This is both the APPC resource name and the name that is used in functional requests from users.

   This is followed by the network TP name LIBMGRTP.

   The keyword SCRDEF precedes the name of the default scratch pool for this host on this library. The default is SCRATCH00.

   The INSERT keyword allows a target category to be specified for automatic insert processing of new volumes inserted in the library. The target must be either SCRATCHnn or PRIVATE. Without this parameter, no automatic insert processing occurs.

   An optional INSMSG keyword allows the messages and mount queuing to be enabled or disabled for mounts that fail with volume-not-found condition. The character Y (for yes) enables this capability, N (for no) disables it. If this parameter is omitted, messages are issued and mounts are queued. (That is, the default is INSMSG=Y.)

   There is one Library_ID statement for each attached IBM Automated Tape Library. The Library_ID in the first statement specified is the ID used if the user request does not specify which IBM Automated Tape Library to use.

   Device_List defines the serial number of the IBM Automated Tape Library attached and the addresses of the tape drives within that are to be used.

Msg_Level determines which messages are written to the system console.

Query_Inv_List designates the name for the predefined library in which Query Inventory (QI) member lists are to be created.

Manage_Inv_List designates the name of the predefined library from which Manage Inventory (MI) member lists are to be read.

7. Start LCDD

   Figure 69 shows sample job control statements for starting the LCDD. The FSMLCITM phase is expected to reside in the program library established for LCDD code during product installation. In this example, LCDD runs in a dynamic partition. The LCDD control cards following the EXEC statement are described in the *IBM 3494 Tape Library Dataserver User's Guide: Library Control Device Driver for VSE/ESA*.

```
* $$ JOB JNM=LCARUN,CLASS=C
* $$ LST CLASS=C
// JOB LCARUN
// ASSGN SYSLST,PRINTER
// LIBDEF *,SEARCH=(LCA.PROD.LCAINV.LIBMGRLU)
// EXEC PGM=FSMLCITM,SIZE=200K
MSG_LEVEL 1                          * Display max. level msg
LOCAL_VSE_ID VSE1LCA                 * ID of this VSE system
LIBRARY_ID LIBMGRLU LIBMGRTP SCRDEF=SCRATCH00 INSERT=SCRATCH00 INSMSG=Y
DEVICE_LIST 12345678 180 181         * Tape drives
DEVICE_LIST 87654321 1A0             * Tape drive
QUERY_INV_LISTS LIB=LCAINV           * Master inventory files
MANAGE_INV_LISTS LIB=LCAINV          * Manage from master file
/&
* $$ EOJ
```

Figure 69. Sample Job to Start LCDD

Ensure that VTAM is active before starting the LCDD job and that the 3494 Library Manager is already online. After the LCDD starts, it performs a set of initialization tasks before it becomes active and capable of accepting user requests. Part of the initialization scenario involves exchanging messages with the 3494 Library Manager.

During initialization processing, the communication paths are verified and the Library Manager sends configuration data for installed library hardware to the LCDD. The LCDD uses the configuration data to complete its in-storage control block structures required for conducting further communications with the Library Manager and servicing user requests for library functions.

After initialization is successfully completed, the following message is displayed on the console, and both the MSG command and the programming interfaces are enabled:

```
LCAxxx2307I LCDD is initialized and ready for service
```

If the LCDD cannot connect to the 3494 Library Manager, or if the 3494 Library Manager returns configuration information that does not match any data provided in the DEVICE_LIST control card, this message is displayed on the console and the LCDD goes into a wait state until the 3494 Library Manager sends configuration data.

```
LCAxxx2315I Initialized processing awaits configuration data
```

If configuration data was sent by the Library Manager but does not match the DEVICE_LIST control-card input, an additional message (LCAxxx2317W) indicates that no library drives are initialized. In this case, check the control card DEVICE_LIST. Make any needed corrections and then stop and restart LCDD.

If the Library Manager is online and operational and the LCA2315I message is displayed without the LCA2317W message, or if neither the LCAxxx2307I nor the LCAxxx2315I message is written on the console during the initialization, there is a possible error in the VTAM or Library Manager communications definitions. Cancel the LCDD job and restart it after the configuration problems are resolved.

8.1.2 Considerations

The following points should be considered for implementing the LCDD for VSE/ESA:

- Control data sets

  There is no tape inventory control data set on VSE/ESA, such as the TCDB for DFSMS/MVS and the BTLS catalog for BTLS. You can, however, store volume inventory lists as members of a VSE/ESA Librarian facility (data set) by using query functions provided by the LCDD. An inventory list for the entire 3494 can be used as a point in time host backup of the 3494 status of tape processing and is thus potentially useful for recovery purposes.

  Your tape management system will typically have an up-to-date list of host-owned volumes, and an interface with which to synchronize the list with the Library Manager.

  The LCDD startup deck is the sole source of information on the IBM Automated Tape Librarys and tape drives installed.

- Insert processing

  All volumes that are inserted into the IBM Automated Tape Library are available for LCDD automatic insert processing, if this was set up at LCDD startup, by using the INSERT keyword of the Library_ID keyword. It is possible to use the LCABAT batch program or the MSG operator interface commands to handle the insert operation.

  All volumes that are inserted into the IBM Automated Tape Library are available for the LCDD to insert according to whatever settings have been made. The LCDD does not keep any lists of external volume labels and the category to which they should be assigned if inserted into the library.

  The only exception to the above is when a specific volume is requested in VSE/ESA and not found in the IBM Automated Tape Library. In this case, when the volume is placed in the IBM Automated Tape Library, it will be inserted as PRIVATE by the LCDD. However, it is possible for any other attached host to process that volume before the requesting LCDD recognizes its presence. In this case, the operator message requesting the volume insert must be replied to by the operator in order to redrive the mount and proceed with job processing.

- Tape management system

  IBM does not provide a tape management system for VSE/ESA. Users must consider using another vendor's tape management system or local tape

management software to invoke 3494 interfaces under program control. We list some vendor VSE Tape Management products in: 7.7, “Tape Management System Considerations” on page 143.

8.2 Partitioning

In this section we describe partitioning drives and volumes in an IBM Automated Tape Library between a VSE/ESA LCDD system and other systems.

8.2.1 Partitioning Drives

The startup deck determines which tape drives are available to a VSE/ESA LCDD system. To partition, ensure that each LCDD is started up only with the drives it may use and that no other system attached to the same IBM Automated Tape Library has access to those tape drives.

8.2.2 Partitioning Volumes

As with all systems, the knowledge of a volume′s external label means that you can request that volume specifically, no matter which system sharing the IBM Automated Tape Library “owns” it and no matter which Library Manager category it belongs to. You must institute controls to ensure that volumes in the IBM Automated Tape Library can be accessed only by the systems you want to access them. This must be done by restricting each sharing system to access only the volumes you want it to access.

The LCDD has no mechanisms itself to control which volumes it may or may not access in the library, apart from scratch categories. Control of this must come from an external mechanism, such as a tape management system, to ensure that the LCDD is not used to mount volumes belonging to another system.

To partition scratch categories between multiple VSE/ESA LCDD systems, the partitioning of volumes would need to be made by the tape management system or the programs requesting the scratch mounts. It is possible for each LCDD to have a different scratch category (SCRATCHnn, when nn is 00 to 31). The scratch category can be set in the SCRDEF startup parameter of Library_ID to be different for every LCDD partitioning the IBM Automated Tape Library. However, it is anticipated that this would not be sufficient as each system is likely to need at least two scratch categories, one for each media type. Again, this means that it is the responsibility of the tape management system to ensure that it uses only its own scratch categories in the IBM Automated Tape Library.

The AIX/6000 and ADSM/6000 systems are capable of setting up their scratch categories to be the same as those used by the LCDD. They must be checked to ensure that this does not happen.

8.3 Sharing

In this section we describe sharing drives and volumes in an IBM Automated Tape Library between an LCDD system and any other system.

8.3.1 Sharing Drives

All tape drives that an LCDD can use are defined in the startup deck in the DEVICE_LIST keyword. You must ensure that all tape drives to be shared are defined to all hosts.

Once a tape drive is ONLINE to the VSE/ESA LCDD system, it is not possible for any other system sharing the IBM Automated Tape Library to have access to it. Attempts to access it from any other system are rejected. The tape drive must be made OFFLINE to this VSE/ESA system before any other sharing system may acquire it for its own use. You will need to institute procedures to ensure the release of tape drives after use by LCDD to allow other systems to gain access to them. The ONLINE and OFFLINE commands are operator commands.

The widely used vendor's VSE/ESA tape management products handle sharing of tape drives by multiple VSE/ESA host systems. Please contact the vendor for further details.

8.3.2 Sharing Volumes

In this section we describe how to share any volume and how to share scratch categories between LCDD and any other system sharing an IBM Automated Tape Library.

8.3.2.1 Sharing Any Volume

Sharing the control of volumes between an LCDD system and any other is determined by the sharing of the information of the external labels of the volumes and any other information such as characteristics and contents. Most of the vendor's tape management systems support shared catalog on shared DASD with multiple VSE/ESA host systems. Your tape management system is likely to contain more information about the volumes, and you should investigate which facilities it provides for sharing and/or communicating information between systems.

8.3.2.2 Sharing of Scratch Categories

Sharing of scratch categories can be done between an LCDD system and any other LCDD system, or an AIX/6000 system. Each LCDD system uses the same category for each instance of SCRATCHnn. If nn is not specified, the default category when SCRATCH is specified is set in the startup deck for each LCDD, and it could be the same for each LCDD if you want.

If you want to share scratch categories with an AIX/6000 system, you must define its scratch categories to match those of the LCDD system. Table 17 on page 177 lists the categories.

Note: VSE will claim any volume during its automatic insert processing. There is no filter facility to restrict it to designated volume serial ranges. In situations where you share or partition the IBM Automated Tape Library between VSE and other hosts, you may want to turn the VSE automatic insert processing off and on dynamically. If VSE automatic insert processing is left on all the time, no other host can successfully process inserted volumes.

8.4 Volume Transfer

The LCDD has no host control dataset, so the details of volume transfer will depend on the Tape Management System of the source and target systems.

The LCDD provides you with facilities to change a volume′s category with the Set Volume Category (SV) command (entered by batch, through the VSE/ESA MSG operator command interface, or by an Attention Routine). You must provide the external volume label to the command. A volume can be assigned to any category that the LCDD knows, including INSERT.

Chapter 9. Implementation in an AIX/6000 Environment

In this chapter, we explain the basic factors to consider when implementing sharing and partitioning of an IBM Automated Tape Library in an AIX/6000 environment.

The AIX device driver provides basic support for controlling the IBM Automated Tape Library from a RISC/6000. ADSM/6000 provides IBM Automated Tape Library management functions using this device driver. In this section, we explain the basic factors to consider when sharing and partitioning an IBM Automated Tape Library in an AIX/6000 environment, whether using ADSM/6000 or not.

9.1 Basic Implementation

This section describes in detail the drivers provided with the IBM 3490E, and 3590 devices, and the way they interact with the AIX operating system, depending on what type of channel is used for connection.

In an AIX/6000 environment, three kinds of channel attachment can be used to connect to an IBM Automated Tape Library: ESCON, parallel and SCSI. The device drivers are different for each channel attachment.

Information about the installation tasks for each device driver can be found in the *AIX Parallel and ESCON Channel Tape Attachment/6000 Version 3 Release 1.0 Installation and User's Guide* and the *IBM SCSI Tape Drive, Medium Changer, and Library Device Drivers Installation and User's Guide*.

These AIX drivers are required in all configurations, even with ADSM. ADSM may provide new functionalities regarding the use of an IBM Automated Tape Library but these primary drivers (so called “atape”, “atldd”) are mandatory.

Information about the installation tasks for ADSM/6000 can be found in the *ADSTAR Distributed Storage Manager/6000 Installing the Server and Administrative Client* and *ADSTAR Distributed Storage Manager/6000 Administrator's Guide*.

9.1.1 Device Drivers for Tape Devices

There are three types of tape device drivers for SCSI, ESCON, and parallel attachment.

9.1.1.1 SCSI Attachment

When IBM 3490E or 3590 tape drives are attached to AIX system through SCSI interface, the following device driver is required.

- IBM Tape Device Driver/AIX enhanced (atape)

The driver requires an SCSI-2 Differential interface card on the RISC/6000 and a minimum level of AIX 3.2.4 (and later) or 4.1.1 (and later).

No specific driver is required to support SCSI-2 interface cards.

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9.1.1.2 Parallel and ESCON Attachment

When IBM 3490 or 3490E tape drives are attached to AIX system through ESCON or parallel channel, the following device driver is required.

- IBM Tape Attachment/6000 (mtdd)

Use of the mtdd supposes a parallel or ESCON interface card (S/370 or S/390 Channel Emulator/A on the RISC/6000) and a minimum level of AIX 3.2 with PTF U405589 and PTF403146, or AIX 3.2 installed on a RISC/6000.

Specific support programs are provided with the channel emulators:

- IBM Parallel Channel support (s370.driver)
- IBM ESCON Channel support (s390.driver).

9.1.1.3 Content of the Device Drivers

All the tape device drivers provide commands, depending on the way the RISC/6000 is attached:

- Parallel and ESCON Attachment Device Driver (mtdd) provides **assign** and **mtmode** commands.
- SCSI Attachment Device Driver (atape) provides the **tapeutil** command.

assign allows you to assign/unassign the drive manually.

mtmode allows you to change the recording mode, depending on which tapes are used (for example: 6250 bpi mode for the IBM 3420, 3422 and 3430, compacted mode for the IBM 3480 and 3490). Recording mode is neither described nor discussed here. Please refer to *AIX Parallel and ESCON Channel Tape Attachment/6000 Version 3 Release 1.0 Installation and User's Guide* for more details.

tapeutil allows you to perform all ordinary SCSI operations on a tape drive, provided with an ACF or not. For example, you can unload, move a tape, or query information.

9.1.2 Device Driver for Library Manager of Tape Library

This device driver is provided only with the IBM Automated Tape Library.

The IBM AIX Automated Tape Library Device Drive LAN/TTY and the Tape Attachment/6000 software provide the following driver:

- IBM Automated Tape Library device driver (atldd.driver)

This driver provides the **mtlib** command.

mtlib allows you to perform all operations on the tape drives and the Library Manager in an IBM Automated Tape Library. For example, you can mount or demount a tape, change a volume category, or eject a tape.

9.1.2.1 SCSI Attachment

If the tape drive is attached using SCSI channels, the data is sent via the SCSI path but the library control commands are sent via an RS-232 or LAN connection to the Library Manager (see Figure 70 on page 155). The LAN physical link is token-ring or Ethernet.

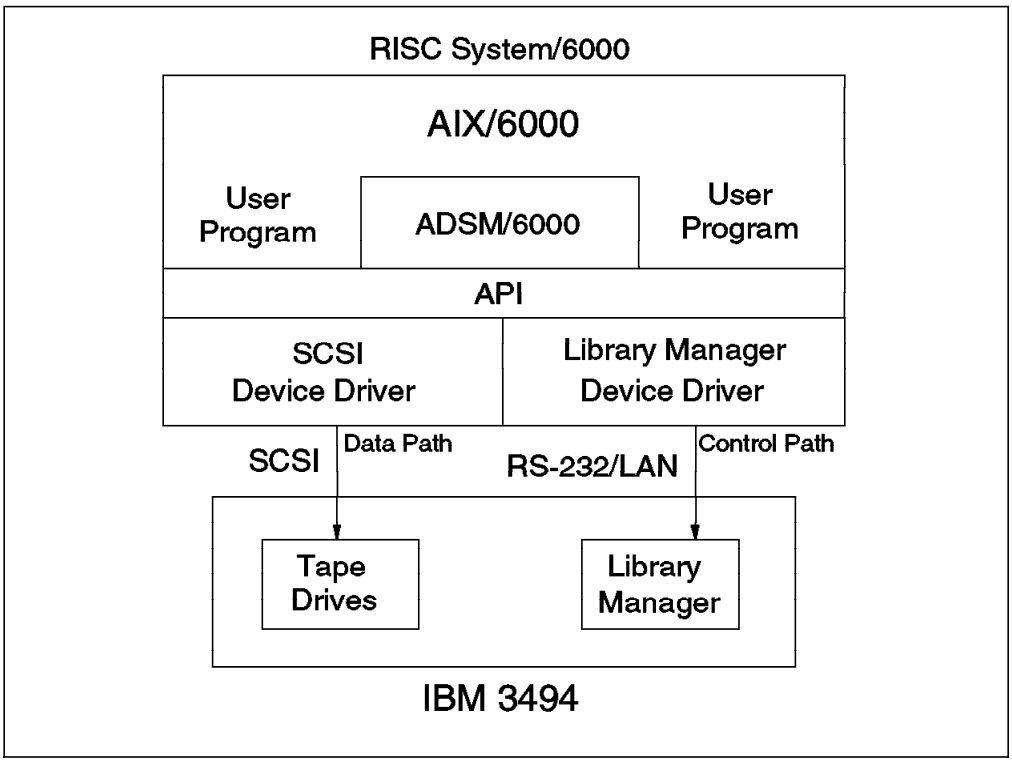

Figure 70. AIX/6000 and IBM 3494 IBM Automated Tape Library: SCSI Attachment

9.1.2.2 Parallel and ESCON Attachments

When the driver is connected to a RISC/6000 through a parallel or ESCON attachment, no specific control path is needed. Both data and control commands use the parallel or ESCON channel. See Figure 71 on page 156.

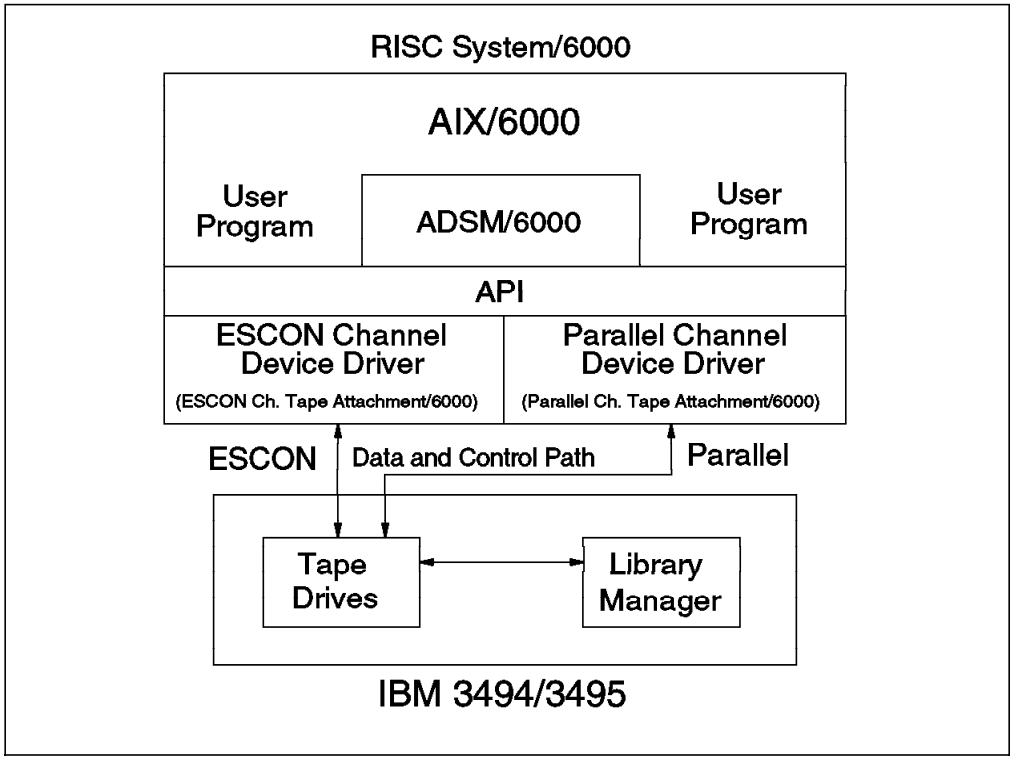

Figure 71. AIX/6000 and IBM 3494/3495 IBM Automated Tape Library: ESCON/Parallel Channel Attachment

9.1.3 AIX Daemons

Once all the mandatory drivers have been installed, there is only one permanent active daemon related to the IBM Automated Tape Library. This daemon, called **lmcpd**, ensures a permanent communication between AIX and the Library Manager inside the tape library.

A kernel process called **kproc** manages all of the communication between the libraries connected to the AIX system. All data to and from the library is sent to **kproc**.

9.2 Sharing

To share an IBM Automated Tape Library, all attached host systems must share the host control data set in order to have identical volume status information. For AIX using ADSM, the ADSM server cannot share an ADSM library inventory database that contains control information of ADSM for AIX. Therefore, the IBM Automated Tape Library must be partitioned for multiple ADSM servers to use the same tape library. Please refer to Section 9.4.2, “ADSM/6000 Environments” on page 162 for detail.

9.3 Tape Drive Assignment

Tape drive assignment in the AIX environment is described in Section 4.5.5, “AIX/6000 Environments” on page 83, and Section 4.5.6, “ADSM/6000 and ADSM/400 Environments” on page 84.

AIX and ADSM cannot check the availability of a tape drive before using it. Therefore if a tape drive is not available when ADSM requests one, the request fails. In addition, if AIX or ADSM is using all available tape drives at the time the other host system requests one, the request fails.

The only way of avoiding problems when several drives are needed and several read/write jobs have to be performed without interruption (backup operations, recycle, ADSM reclamation or collocation) is to temporarily partition the drives. Use VARY ON/VARY OFF (or the equivalent command) on the mainframe host or DEFINE/DELETE (ADSM command) and **mkdev/rmdev** (AIX command) on the AIX host.

Some AIX commands internally issue hardware SCSI RESERVE/RELEASE I/O command or use ASrSIGN/UNASSIGN CCWs. For example:

- The **tar** command uses **open** and **close** system calls for every file dumped to the tape. The **open** system call issues the RESERVE or ASSIGN I/O command, and the **close** system call issues the RELEASE or UNASSIGN I/O command, depending on the tape drive I/O interface.
- The **tapeutil** command can issue the RESERVE and RELEASE SCSI I/O commands.
- The **assign** command can issue the ASSIGN and UNASSIGN CCWs.
- The **mtlib** command automatically issues the RESERVE or ASSIGN I/O command when a tape volume is mounted on a tape drive inside the tape library. To request a demount, the **mtlib** command issues the RELEASE or UNASSIGN I/O command.

The examples and commentary in the sections follow apply to all available connections to an AIX system (SCSI, parallel, and ESCON), unless otherwise stated.

As described in Section 4.5, “Tape Drive Assignment” on page 78, traditionally, the keywords reserve/release and assign/unassign tape drives belong to different operating systems—UNIX and the mainframe operating systems, respectively. In the discussion below, we use the word *assign* to describe the action of a RESERVE or an ASSIGN hardware I/O command. We use the word *unassign* to describe the action of a RELEASE or UNASSIGN hardware I/O command because the global meaning of these hardware I/O commands is the same.

9.3.1 Sample Commands: Tape Drive outside Tape Library

The following AIX commands control tape drive assignment outside the tape library.

- **tar -xvf /dev/rmt0**: opens the /dev/rmt0 file and assigns the rmt0 drive to the system issuing the command. Any other user attempting to access the drive will receive an error message. The device is unassigned at the end of the tar command. If you have to be sure that you will keep the drive between two tar operations, you have to use the tapeutil or assign program.

- **tapeutil -f/dev/rmt0 reserve**: assigns the rmt0 drive to the system issuing the command
- **tar -cvf /dev/rmt0 ***: writes on tape
- **tapeutil -f/dev/rmt0 release**: unassigns the rmt0 drive, makes it available again to all the systems to which it is connected.
- **assign -af/dev/rmt0** : assigns the rmt0 drive to the system issuing the command
- **tar -cvf /dev/rmt0 ***: writes on tape
- **assign -uf/dev/rmt0**: unassigns the rmt0 drive, makes it available again to all the systems to which it is connected.

9.3.2 Sample Commands: Tape Drive inside Tape Library

We show **mtlib** command examples for controlling tape drive assignment inside the tape library.

The **mtlib** command automatically assigns the drive to which it is bound. For example:

- **mtlib -l/dev/lmcp0 -mf/dev/rmt0 -VVOL001**: assigns the rmt0 drive and mounts the VOL001 tape on it.
- **tar -cvf /dev/rmt0 ***: writes on tape
- **mtlib -l/dev/lmcp0 -df/dev/rmt0 -VVOL001**: unassigns the rmt0 drive and dismounts the VOL001tape.

Any other user attempting to access the drive will receive an error message.

Figure 72 is an example of a shell script showing several steps of mount, demount, write, eject, change category, and so on.

```
mtlib -l /dev/lmcp0 -mf /dev/rmt0 -VAIX001
mtlib -l /dev/lmcp0 -mf /dev/rmt1 -VAIX002
tar -cvf /dev/rmt0 ./
tar -cvf /dev/rmt1 /usr/lpp/*
mtlib -l /dev/lmcp0 -df /dev/rmt0 -VAIX001
mtlib -l /dev/lmcp0 -df /dev/rmt1 -VAIX002
mtlib -l /dev/lmcp0 -CV AIX001 -tFF10
mtlib -l /dev/lmcp0 -qL
mtlib -l /dev/lmcp0 -mf /dev/rmt0 -VAIX002
tar -tvf /dev/rmt1
mtlib -l /dev/lmcp0 -df /dev/rmt0 -VAIX002
```

Figure 72. Example of Using MTLIB to Automate TAR Backup

This shell script requests the following actions:

1. Mount tape AIX001 onto drive rmt0
2. Mount tape AIX002 onto drive rmt1
3. tar all files and subdirectories under the home directory to tape AIX001
4. tar all files under the /usr/lpp directory to tape AIX002
5. Demount tape AIX001

6. Demount tape AIX002
7. Eject tape volume AIX001 from the library (FF10 volume category means EJECT).
8. Query information about the tape library
9. Mount tape AIX002 on drive rmt0
10. List the content of tape AIX002
11. Demount tape AIX002.

For more details about **mtlib** commands, please refer to *AIX Parallel and ESCON Channel Tape Attachment/6000 Version 3 Release 1.0 Installation and User's Guide*, and *IBM SCSI Tape Drive, Medium Changer and Library Device Drivers Installation and User's Guide*.

9.3.3 ADSM/6000

When ADSM requests a tape mount, it acts the same way as an **mtlib** command. This means that it assigns the drive to its application until the request is finished. Any other user attempting to access the drive will receive an error message.

Several ADSM operations require two drives (RECLAMATION, COLLOCATION, and BACKUP STGPOOL are examples). In such a configuration, you need to be sure that no one can steal the drive during the reclamation process.

9.4 Partitioning

In this section, we explain the implementation considerations for partitioning an IBM Automated Tape Library between other systems and AIX/6000 in both a non-ADSM and an ADSM environment. We explain the general considerations for partitioning an IBM Automated Tape Library in Chapter 4, “Multisystem Access” on page 63.

9.4.1 Non-ADSM Environments

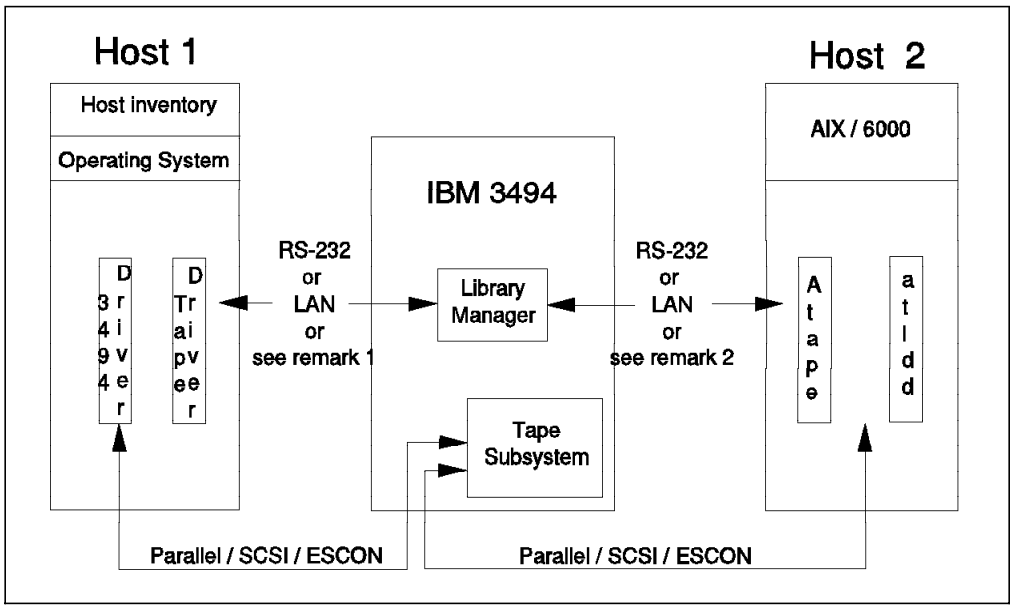

Figure 73. Partitioning between AIX/6000 and Another System

Remark 1 RS-232 or LAN control path connections are required if the data path is a SCSI type, or if the host is an AS/400 and the data path is a parallel type.

Remark 2 RS-232 or LAN control path connections are required on Host 2 if the data path is a SCSI type.

9.4.1.1 Volume Category Assignment

In a non-ADSM environment, AIX has no tape inventory database, assigns no default volume category to cartridges and does not use internal labels. Consequently, AIX can write (for example, make a **tar**) on any tape cartridge, whatever its label or category. It is not possible to protect a tape cartridge from an AIX direct read/write operation.

To assign your own volume category to a tape cartridge, use the **mtlib** AIX command. This protects it from other software, such as ADSM, BRMS/400, or DFSMS/MVS, because such programs check their own inventory and the volume category of a tape cartridge before using it. But assigning a volume category cannot protect your tape cartridge from an AIX **tar** command operation.

The only recommendation we can make in a non-volume-managed environment is to be careful, and track the use of your cartridges.

9.4.1.2 Drive Assignment

As it is powering on, an AIX machine detects all local devices connected to it and makes them available. By using the standard AIX device drivers provided with the tape drives, it is possible to reserve/release the drives manually. The utility programs provided for this purpose are different, depending on the attached channel. For example, in an IBM Automated Tape Library equipped with IBM 3490E or 3590 drives, with a SCSI attachment, you can invoke the **tapeutil** command, open a device, reserve the device, and release the device. These actions can also be done automatically. With ESCON or parallel channel attachment, the **assign** AIX command is provided.

The use of these commands is described in 4.5.5, “AIX/6000 Environments” on page 83. The default behavior of the drives is as follows:

> When the RISC/6000 powers on and configures the devices, it does not place a reserved or assigned status on them, so the drives are seen as available on the AIX host. If an application on the RISC/6000 issues an **open** system call to the device driver, the driver places a reserved or assigned status on the device opened, preventing other applications from using it. When the application issues a **close** system call to the device driver, a RELEASE or UNASSIGN hardware I/O command is sent to the device so that other applications (and systems) can use it.

9.4.1.3 Examples

According to the configuration shown in Figure 73 on page 160, the sequence of commands that switches a tape drive between the two hosts is described below for an MVS sharing a tape library with an AIX host system.

Step 1: on MVS Make a tape drive (device number 101) inaccessible from an MVS system (Host 1) by issuing the command

```
V 101,OFFLINE
```

Step 2: on AIX Define the tape drive (*rmt1*) on an AIX system (Host 2) using

```
mkdev -l rmt1
   or
cfgmgr
```

Step 3: on AIX Assign the tape drive to the AIX system using

```
assign -af /dev/rmt1          /* for SCSI device
     or
tapeutil -f/dev/rmt1 reserve  /* for ESCON/parallel device
```

Step 4: on AIX Perform read and write operation for the tape drive from the AIX system

```
Execute program or command of the AIX
```

Step 5: on AIX Unassign the tape drive from the AIX system

```
assign -uf /dev/rmt1          /* for SCSI device
       or
tapeutil -f/dev/rmt1 release  /* for ESCON/parallel device
```

Step 6: on AIX Remove the tape drive from the AIX system

```
rmdev -l rmt1
```

Step 7: on MVS Make the tape drive accessible from the MVS system

```
V 101,ONLINE
```

For more details about **assign**, **mtmode** and **tapeutil** commands please refer to *AIX Parallel and ESCON Channel Tape Attachment/6000 Version 3 Release 1.0 Installation and User's Guide*, and *IBM SCSI Tape Drive, Medium Changer, and Library Device Drivers Installation and User's Guide*.

Automate Tape Drive Assignment among AIX Systems: Figure 74 on page 162 is an example of a script shell to assign drives to one system or another, with no risk of I/O error. We still suppose that we have the same configuration. These servers have to be accessible to each other through a remote login operation.

At the power-on, both drives are seen to be available on both systems.

```
/* At the beginning of the program, one drive is dedicated to each host.
   We remove the drive on host1, define it to host2,
   perform ADSM operations, and come back to the original configuration.
/* Remove drive on host 1.
rexec host1_name -lroot_name -ppassword /usr/sbin/rmdev -l rmtx
/* Define drive on host 2.
/usr/sbin/mkdev -l rmtx (or cfgmgr)
/* Perform AIX operations on host 2 with the two drives.
mtlib commands
/* Remove drive on host 2.
/usr/sbin/rmdev -l rmtx
/* Define back the drive to host 1.
rexec host1_name -lroot_name -ppassword /usr/sbin/mkdev -l rmtx (or cfgmgr)
```

Figure 74. Automate Partitioning among AIX Systems

9.4.2 ADSM/6000 Environments

We explain the implementation considerations for partitioning an IBM Automated Tape Library between AIX using ADSM and one or more other systems. Figure 75 shows the partitioning of an IBM Automated Tape Library between ADSM/6000 and another system.

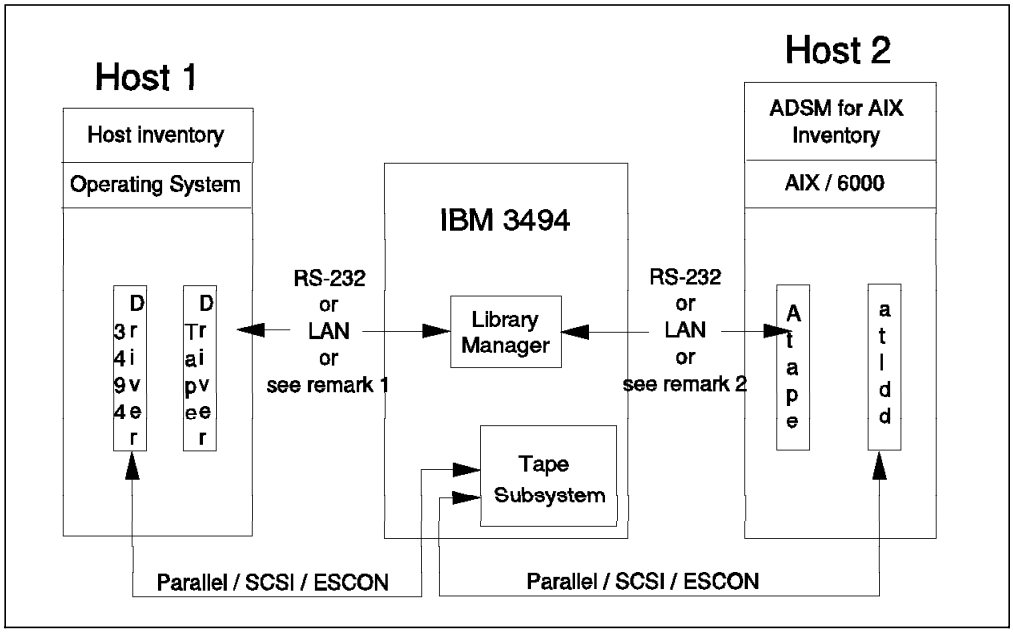

Figure 75. Partitioning between an ADSM/6000 Server and Another System

Remark 1 RS-232 or LAN control path connections are required if the data path is a SCSI type, or if the host is an AS/400 and the data path is a parallel type.

Remark 2 RS-232 or LAN control path connections are required on Host 2 if the data path is a SCSI type.

9.4.2.1 Volume Category Assignment

As defaults, ADSM uses three volume categories. For PRIVATE volumes, ADSM uses volume category X′012C′ (decimal 300) for both IBM 3490 and 3590 cartridges. It uses volume category X′012D′ (decimal 301) for 3490 SCRATCH volumes, and category X′012E′ (decimal 302) for 3590 SCRATCH volumes.

To partition the IBM Automated Tape Library, you must use a different set of volume categories in each system. Appendix A, “Library Manager Volume Categories” on page 177 shows the volume categories that are used for other platforms and subsystems.

ADSM uses the PRIVATE and SCRATCH volume categories of the ADSM. When you define the IBM Automated Tape Library for ADSM using the DEFINE LIBRARY command, you can specify the volume categories for the ADSM-owned PRIVATE and SCRATCH volume categories. In the case of an ADSM and ADSM, you must specify a different set of volume categories for each ADSM/6000.

ADSM can use only the volume that is defined in the ADSM library volume inventory. To partition the volumes, you must define only ADSM-owned volumes to ADSM and other volumes to the other system. Duplicate definitions of a volume can result in simultaneous mount requests from different hosts for the same volume. We recommend that you use a different range of volume serial numbers to partition volumes among multiple systems.

ADSM assigns categories to the volumes that have been defined to it. Those volume categories are defined at the tape library installation by the DEFINE LIBRARY command.

Example *DEFINE LIBRARY library_name LIBT=library_type DEVI=/dev/lmcp0 SCRATCHCAT=300 (=X′012C′) PRIVATECAT=301 (=X′012D′)*

Note: A new scratch category has been introduced to name the new IBM 3590 ADSM scratch volumes. Its default value is 302 (=X′012E′). The private tapes of IBM 3590 have the same category as ordinary ADSM private volumes.

Once the library is defined, the categories cannot be changed. If you use several libraries, you can have different categories for the SCRATCH and PRIVATE volumes, depending on the library they belong to. If several ADSM servers use the same library, you have to use different categories for SCRATCH and PRIVATE volumes in each server.

9.4.2.2 Tape Drive Assignment

In an ADSM environment, the behavior is the same as for non-ADSM environment. RESERVE or ASSIGN and RELEASE or UNASSIGN hardware I/O commands are automatically associated with the applicable tape mount request.

9.4.2.3 Automate Tape Drive Assignment among ADSM Servers

These servers have to be accessible to each other through a remote login operation. In the following examples, we suppose that TCP/IP is available on all the hosts, and we use the remote execution program called *rexec*. Any other remote execution program can be used.

AIX and OS/400 ADSM Servers: See Figure 76.

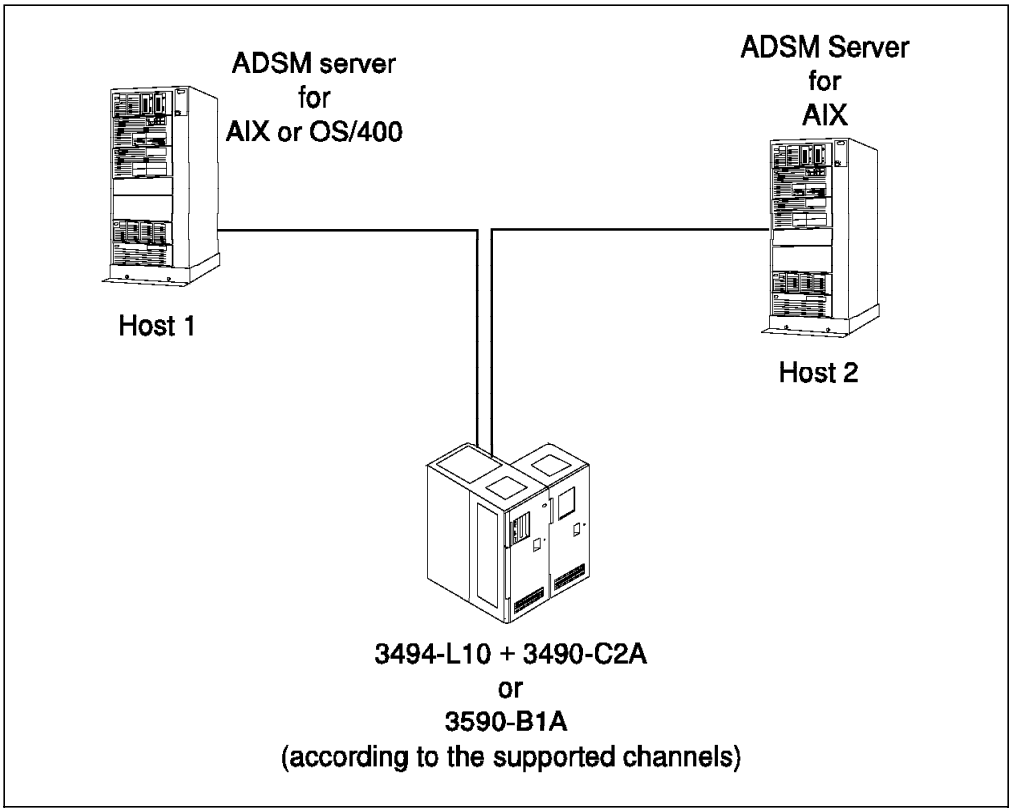

Figure 76. Partitioning between ADSM/6000 and an AIX or OS/400 ADSM Server.

According to the configuration shown in Figure 76, the sequence of commands shown in Figure 77 is to be executed on host 2.

```
/* At the beginning of the program, one drive is dedicated to each host.
   We will remove the drive from host 1, define it to host 2,
   perform ADSM operations, and return to the original configuration.
/* Remove drive from host 1.
rexec host1_name -luser_name -ppassword dsmadmc -id=admin1
        -pa=admin1_password delete drive library1_name drive_name
/* Define drive on host 2
dsmadmc -id=admin2 -pa=admin2_password define drive library2_name
         drive_name devi=/drive_path_name
/* Perform ADSM operations on host 2 with the two drives.
rexec host1_name -luser_name -ppassword Your_command_script
/* Remove drive from host 2.
dsmadmc -id=admin2 -pa=admin2_password delete drive library2_name drive_name
/* Define back the drive to host 1
rexec host1_name -luser_name -ppassword dsmadmc -id=admin1
       -pa=admin1_password define drive library1_name drive_name
       devi=/drive_path_name
```

Figure 77. AIX and AIX or OS/400 ADSM Servers: Partitioning of Drives

AIX and MVS, VM, VSE ADSM Servers: See Figure 78.

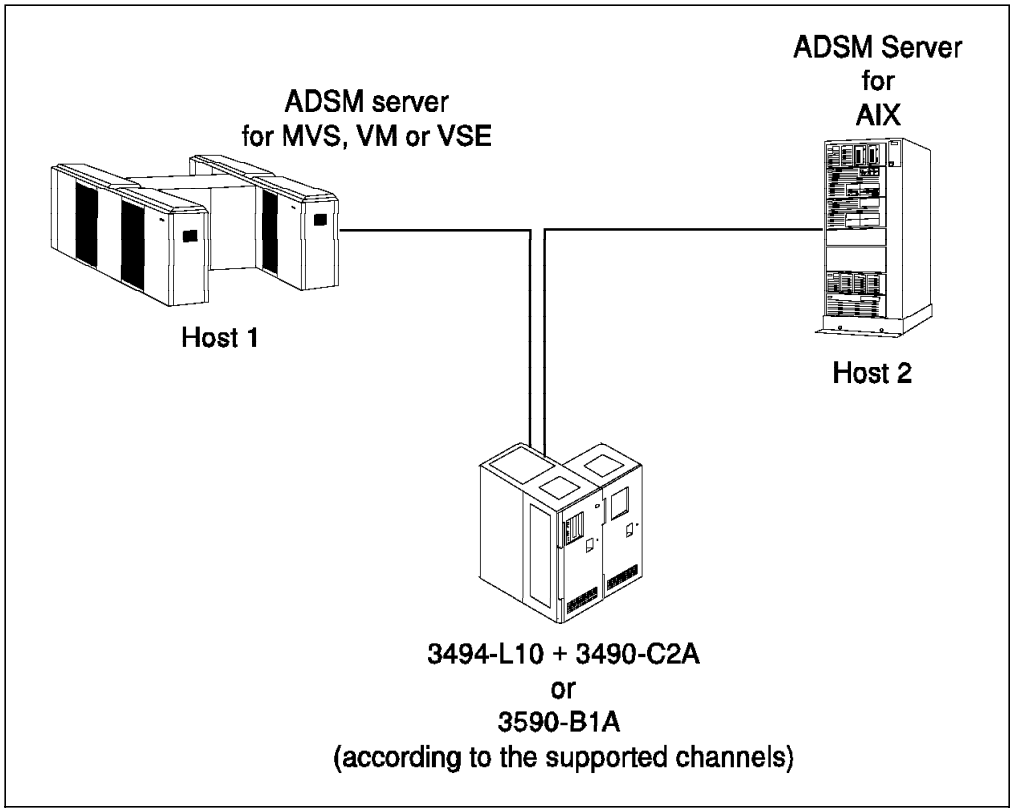

Figure 78. Partitioning between ADSM/6000 and an MVS, VM or VSE ADSM server.

Since there is no DEFINE DRIVE command in MVS, VM or VSE ADSM servers, use the standard VARY ON/OFF (or equivalent) commands to make the drives usable by the ADSM/6000 server. Figure 79 shows the sequence of commands.

```
/* At the beginning of the program, one drive is dedicated to each host.
   We remove the drive from host 1, define it to host 2,
   perform ADSM operations, and return to the original configuration.
/* Remove drive from host 1.
rexec host1_name -luser_name -ppassword VARY cuu,OFFLINE
/* Define drive on host 2.
dsmadmc -id=admin2 -pa=admin2_password define drive library_name
         drive_name devi=/drive_path_name
/* perform ADSM operations on host 2 with the two drives
rexec host1_name -luser_name -ppassword Your_command_script
/* Remove drive from host 2
dsmadmc -id=admin2 -pa=admin2_password delete drive library2_name drive_name
/* Define the drive back to host 1
rexec host1_name -luser_name -ppassword dsmadmc -id=admin1
          -pa=admin1_password VARY cuu,ONLINE
```

Figure 79. AIX and MVS, VM or VSE ADSM Servers: Partitioning of Drives

9.5 Sharing Volumes

This section describes what happens if you must permanently share volumes between two different hosts. Even though such a configuration is theoretically usable, implementing it among two different operating systems is not recommended. The host inventories cannot communicate with any of the AIX software managing tapes (AIX itself or ADSM). Many errors can be expected if the tape inventory is not carefully monitored.

9.5.1 Non-ADSM Environments

9.5.1.1 Volume Category Assignment

Since AIX assigns no specific category to tapes, and has no tape inventory, it allows you to do all read/write operations on all tapes in the library. On the other hand, to make AIX tapes usable by another system, you must assign them volume categories that are accepted by the other host.

Example AIX tapes with volume categories X′0100′ and X′0101′ are usable by both AIX and OS/400 systems.

9.5.1.2 Drive Assignment

See details in 9.4.1.2, “Drive Assignment” on page 160

9.5.2 ADSM Environments

9.5.2.1 Volume Category Assignment

ADSM assigns its own volume categories to the tapes, making it theoretically possible to choose a volume category that would be accepted by two different hosts. However, ADSM labels the tapes and thus makes them unreadable by another host. Sharing of volumes is not possible in an ADSM environment.

9.5.2.2 Drive Assignment

See details in 9.4.1.2, “Drive Assignment” on page 160

9.6 Volume Transfer

This section describes the possibility that you may have to transfer volumes to another host. Even though such an action is theoretically possible, it is difficult to implement except between two AIX systems: First, the host inventories are often strictly restricted to a certain range of external labels and do not accept an out-of-the-range tape, except as a nonlabeled tape. Second, the data is often written on tape using a specific format and is hard to read on another system.

9.6.1 Non-ADSM Environments

Since AIX assigns no specific volume category to tapes, you can transfer a tape to another system just by changing its category. However, the barcode of the tape must belong to a range that is also accepted by the other host.

Example The second host is a DFSMS/MVS environment, and you modified the CBRUXENT exit so that only cartridges called EXP001 to EXP299 can be SMS-managed. If your AIX tape is called EXP300, SMS will not accept it and will eject it as error cartridge.

9.6.2 ADSM Environments

Practically, this possibility cannot be used for the following reasons:

- Only ADSM can read data backed up by ADSM.
- An ADSM server can only read tapes that it labeled itself.

If you want to transfer an ADSM tape to another system, you must perform the following steps:

- Issue the CHECKOUT LIBVOLUME ADSM command with the REMOVE=NO parameter.

  The volume specified by the CHECKOUT command is not ejected physically from the tape library. The volume is put in the insert category (X′FF00′) for other use. But the volume entry in ADSM library inventory is deleted.

- Change its volume category to a host-accepted volume category.

  Note: The REMOVE=YES parameter is available only in ADSM Version 2. If you are using ADSM Version 1, the CHECKOUT LIBVOLUME command physically ejects the volume. So you must insert the volume back into the tape library to transfer the volume to another system.

If the tape has to come back to the previous host (ADSM/6000), you must:

- Change its volume category to the PRIVATE or SCRATCH ADSM category (there is no need to eject the tape this time) using an **mtlib** command.
- CHECKIN the volume.

9.7 Recovery Considerations

This section briefly describes how an IBM Automated Tape Library can be used to backup and recover data using disaster recovery tools. An IBM Automated Tape Library should be considered as a mere hardware tool to manage the tapes; its only specific facility is an automatic inventory of tape volumes. In association with a backup and recovery system such as ADSM, all the facilities provided by ADSM (centralization of backup and archive data, reclamation of tapes, collocation, inventory of all data, users, and volumes) are emphasized by the use of an IBM Automated Tape Library.

9.7.1 Non-ADSM Environments

Tapes that are written using the standard AIX backup tools (**tar, backup, mksysb**) can be read by any other AIX system. Thus, the disaster recovery backups performed on an IBM Automated Tape Library can be used to recover the data on another machine, using the standard recovery tools.

Limitations The bootable system tape created by the Make System Backup (**mksysb**) command cannot be used on ESCON- or parallel channel-attached tape drive to restore the system.

9.7.2 ADSM Environments

ADSM can back itself up, including its database, log, and storage pools. ADSM disaster recovery tapes cannot be used to recover the whole system, only the ADSM server′s data.

In an ADSM configuration, the EXPORT (ADSM Version 1) or the BACKUP (ADSM Version 2) commands will request specific volumes. These volumes will be necessary when issuing the IMPORT (ADSM Version 1) or RESTORE (ADSM Version 2) commands on the new ADSM server. Restoration of the new server will preserve the volume categories, the volume serials, the library names and all volume-related information as defined in the previous server.

Please refer to *ADSTAR Distributed Storage Manager for AIX Administrator Reference Version 2* for more details about the disaster recovery commands.

Chapter 10. Implementation in Other Environments

In this chapter, we explain the basic factors to consider when implementing sharing and partitioning of an IBM Automated Tape Library in an AS/400 environment, or TPF environment.

10.1 AS/400 Environment

IBM 3494 support for the AS/400 environment is supplied in the Media Library Device Driver (MLDD). This is the basic support to control an IBM 3494 from AS/400.

Backup Recovery and Media Services/400 (BRMS/400) uses the interfaces in the MLDD to service IBM 3494 operations for applications or end users. BRMS/400 is the recommended interface to the IBM 3494.

In this subsection, we explain the basic considerations for sharing and partitioning an IBM Automated Tape Library in an AS/400 environment using BRMS/400.

Please see the AS/400 Tape Automation publication *AS/400 Automated Tape Library Planning and Management*.

More information about the MLDD can be found in the *IBM 3494 Tape Library Dataserver User's Guide: Media Library Device Driver for Application System/400*, and about the BRMS/400, in the *Backup Recovery and Media Services/400 Guide* and *Backup Recovery and Media Services/400 Implementation Tips and Techniques*.

10.1.1 Basic Implementation

In this section, we explain the basic implementation of the MLDD and BRMS/400.

10.1.1.1 Installation Tasks for MLDD

The installation tasks for the MLDD are as follows.

1. Sign on to AS/400 as QSECOFR.
2. From the main menu, type **RSTLICPGM** and press PF4.
3. Fill in the menu choices as follows and then press Enter:
   - Product = = > **5798RZH**
   - Type of object = = > ***LNG**
   - Language number ==> **2924** (for English upper/lower case)

   Two product libraries will be created, QMLD and QUSRMLD. In addition to these, a subsystem called QMLDSBS is created.
4. Type the **ADDMLD** command and press PF4 to:
   - Set up the RS-232 or LAN port for IBM 3494 communications
   - Vary on the MLDD line.
5. Type the **INZMLD** command and press PF4 to initialize the MLDD. This initialization command starts jobs QMLMAIN, QMLCOM, and QMLTRACE.

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You can use ENDMLD command to terminate these jobs if you need to do a problem analysis or error recovery.

6. Use the **DSPSTSMLD** command to display the IBM 3494 status:

- Total and available cells
- I/O station status
- Operational state.

10.1.1.2 Installation Tasks for BRMS/400

The installation tasks for the BRMS/400 are as follows:

1. Install BRM Services/400 using the **RSTLICPGM** command to:
   - Gather device information
   - Dynamically build classes, policies, and control groups
   - Set up default backup control groups for full backup of the entire system.
2. Enroll the cartridges in the BRMS/400 media management inventory.
3. Review the BRMS/400 policies and change them to suit your needs.
4. Add further backup control groups for more granular backup.
5. Add archive control groups if needed.
6. Perform initial full save of system to generate save history as a recovery starting point.

10.1.2 Control Data Sets

The BRMS/400 uses its own media inventory for volume management. The media inventory contains the volume serial number, contents, location, container, and status of all volumes. Both active (private) and scratch volumes are carried in the media inventory.

10.1.3 Partitioning

Figure 80 on page 173 shows the partitioning of an IBM 3494 between the BRMS/400 and another system.

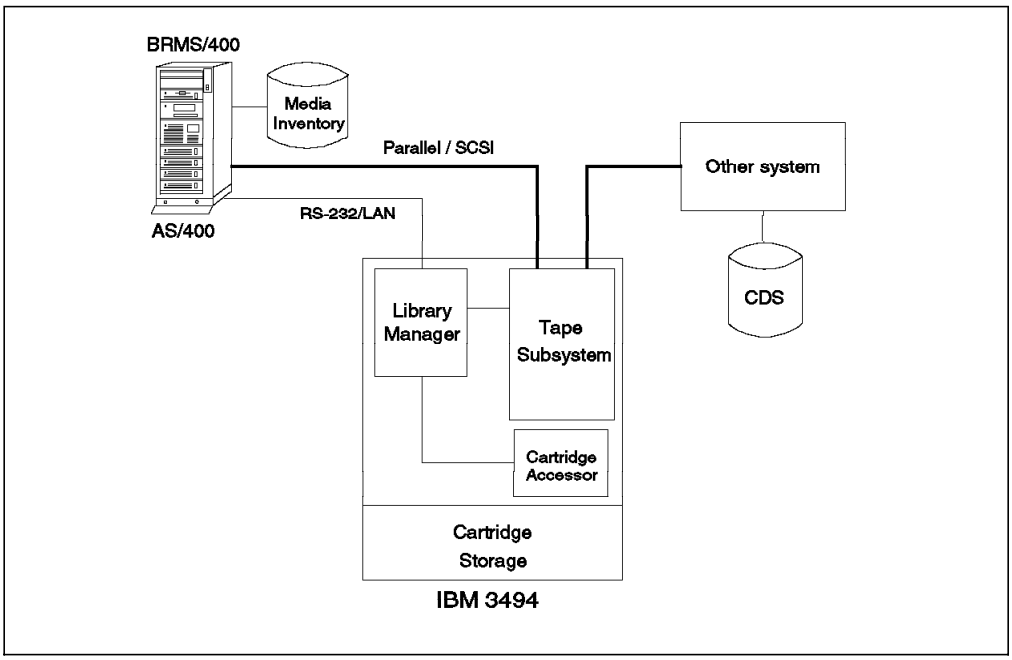

Figure 80. Partitioning between BRMS/400 and Another System

10.1.3.1 Volume Assignment

BRMS/400 usually uses the *SHARE400 and *NOSHARE volume categories and manages private and scratch volumes with its own inventory data. So, when a BRMS/400 requires a scratch mount, it reviews its inventory of available scratch volumes to select one that is already in the IBM 3494 and then requests a mount. BRMS/400 issues only specific mount requests to the IBM Automated Tape Library.

BRMS/400 can use only those volumes that are defined in the BRMS/400 media inventory. To partition, you must define only BRMS/400-owned volumes to BRMS/400 and define other volumes to the other system. We recommend using a different range of volume serial numbers to partition volumes among multiple systems.

10.1.3.2 Tape Drive Assignment

A tape drive can be online to only one host system at a time.

10.1.4 Sharing

To share an IBM 3494, all attached host systems must share the host control data set in order to have identical volume status information in the 3494. The BRMS/400 cannot share an IBM Automated Tape Library with any other type of system.

Figure 81 on page 174 shows the sharing of an IBM 3494 among multiple AS/400s with BRMS/400 installed on each.

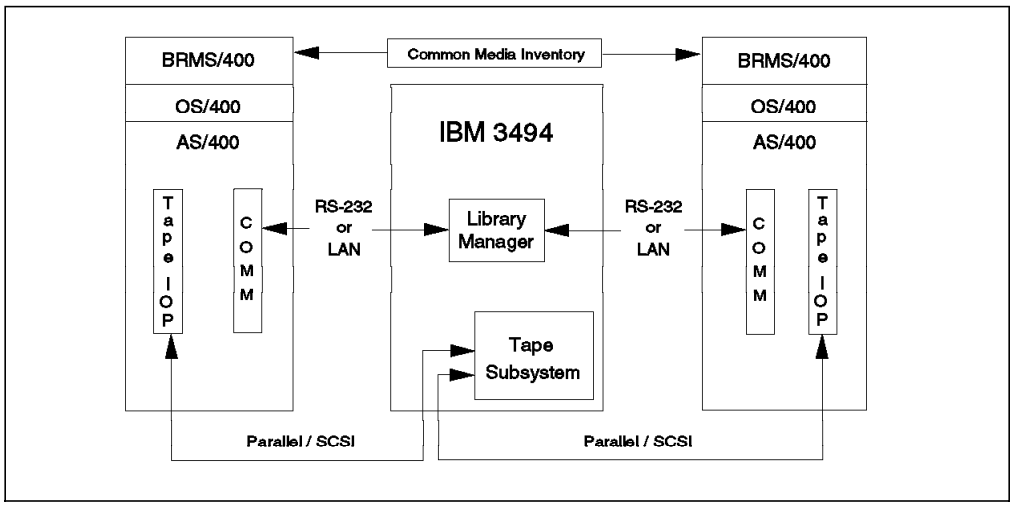

Figure 81. Sharing among Multiple AS/400s with BRMS/400

10.1.4.1 Volume Assignment

When BRMS/400 controls the IBM 3494, the cartridges can be shared with any of the attached AS/400s using the common media management feature of the BRMS/400. This is quite commonly done when display station passthru is configured between the systems. To implement common media management, you need to define an APPC link among the systems.

10.1.4.2 Drive Assignment

Tape drives residing in an IBM Automated Tape Library can be online to either one or both systems at once. This is defined in the device description for the drive itself. If online to both, it is the user's responsibility to manage drive contention from both systems. This method is not recommended. Sharing of a drive that is online to only one system is performed by varying on and allocating the drive for exclusive use, then deallocating and varying off when finished. When varied on and allocated, the other system cannot use the drive.

10.1.5 Volume Transfer

To transfer volumes from an OS/400 to another system, remove the volume definition from BRMS/400 (RMVMEDBRM BRMS command), then eject the volume from the IBM Automated Tape Library (RMVTAPCTG OS/400 command). The volume can then be reinserted in the IBM Automated Tape Library for insert processing and use by another system.

OS/400 also provides you with the facility to change a volume's category to a category usable by another system. You may want to do this to make an AS/400-owned volume temporarily readable from an ES/9000 system, for example. Use the CHGTAPCTG (Change Tape Cartridge) CL command. This also updates the library manager database information for the cartridge concerned to reflect the new category. You must then take appropriate action on your target system.

To avoid inconsistencies in the host system control data sets, define a volume in only one control data set. Duplicate definitions of a volume can result in simultaneous mount requests from different hosts for the same volume.

10.2 TPF Environment

We explain the TPF support in 3.9, “Transaction Processing Facility (TPF)” on page 61.

The ZTPLF command interface does not require any special implementation or installation.

10.2.1 Partitioning

In this section, we explain the implementation considerations for partitioning the IBM Automated Tape Library between TPF and other systems.

10.2.1.1 Volume Assignment

The TPF host does not keep a record of the volumes in the IBM Automated Tape Library, and there is no IBM Tape Management system product for TPF. The process for using tapes is to request (reserve) a general-purpose volume category or categories from the Library Manager, and then issue commands against volumes in the insert category to change their category to one you have reserved. Volume mounts can then be requested by category only.

Volume-mount requests that include a volume serial number with a category will be checked to see if the volume serial number has the specified category assigned in the Library Manager. If they do not match, the mount will be refused. However, there is no check as to whether the category is one previously assigned to that TPF host. As long as you know the volume serial and category, the TPF host will allow you to mount tapes used by other hosts.

We recommend using a different range of volume serial numbers to partition volumes among multiple systems.

10.2.1.2 Drive Assignment

To partition an IBM Automated Tape Library, you have to assign a set of tape drives inside the tape library to the TPF system, and a different set of tape drives to other systems.

10.2.2 Sharing

To share an IBM Automated Tape Library, all attached host systems have to share the host control data set in order to have identical status information about volumes in the IBM Automated Tape Library.

10.2.2.1 Volume Assignment

TPF systems have no host control data set for IBM Automated Tape Library volumes. There is no restriction on your ability to assign general- purpose volume categories to tapes, and have them mounted. The Library Manager is the only source of information about volumes and their categories. TPF systems can therefore share an IBM Automated Tape Library with other TPF systems, within the constraints of having to manually assign categories to volumes.

TPF systems should not share scratch pools in an IBM Automated Tape Library with other hosts. Other hosts use the concept of a control data set to keep status information about their tapes, and although TPF systems could share and use the tape pools and categories, TPF systems do not update other hosts′ control data sets with changed status information. Cross-platform sharing of private volumes is possible with care.

10.2.2.2 Drive Assignment

Tape drives can be allocated to or removed from TPF systems by operator command. When a tape drive has been removed from the TPF system, it can then be used by another system. TPF handles the hardware ASSIGN and UNASSIGN processing to prevent another host from taking a drive TPF is using. There is no dynamic drive sharing in TPF.

10.2.3 Volume Transfer

TPF allows you to mount volumes in the IBM Automated Tape Library, even if they are not owned or normally used by the TPF host. TPF also allows you to change the category of volumes in the IBM Automated Tape Library. So, you could easily change the category of a volume used by a TPF host to a category usable by another host. This flexibility offers broad scope for volume transfer.

Remember that all the normal considerations still apply. For example, the control data set on a target host system may need updating if you plan to transfer a volume from TPF to the target host.

Appendix A. Library Manager Volume Categories

Table 17 lists all Library Manager volume categories and indicates on which platforms they are used and their meaning.

Table 17 (Page 1 of 7). Library Manager Volume Categories

Category (in hex)	Used by	Definition
0000	All Hosts	Indicates to the Library Manager that the category already assigned to the volumes is to be used. Hosts cannot assign volumes to this category.
0001	DFSMS/MVS	Indicates scratch MEDIA1. Volumes in this category are mounted in the ICLs of tape drives inside an IBM 3495 that have a category of MEDIA1 assigned, or directly into any drive on request for a MEDIA1 scratch volume. MEDIA1 is a standard capacity cartridge system tape.
0002	DFSMS/MVS	Indicates scratch MEDIA2. Volumes in this category are mounted in the ICLs of tape drives inside an IBM 3495 that have a category of MEDIA2 assigned, or directly into any drive on request for a MEDIA2 scratch volume. MEDIA2 is an enhanced capacity cartridge system tape.
0003	DFSMS/MVS	Indicates scratch MEDIA3. Volumes in this category are mounted in the ACFs of tape drives inside an IBM 3495 that have a category of MEDIA3 assigned, or directly into any drive on request for a MEDIA3 scratch volume. MEDIA3 is the IBM 3590 High Performance Tape Cartridge.
0004 to 000D	DFSMS/MVS	Reserved
000E	DFSMS/MVS	Indicates an error volume. Volumes in this category are scratch volumes for which the software detected an error during processing.
000F	DFSMS/MVS	Indicates a private volume. Volumes in this category contain user data or are assigned to a user.
0010 to 007F	DFSMS/MVS	Reserved. These volume categories will be used for the partitioning user modification described in 5.3.1.2, “User Modifications” on page 100.
0080	DFSMS/VM	Indicates that the volume belongs to the VM category SCRATCH0
0081	DFSMS/VM	Indicates that the volume belongs to the VM category SCRATCH1
0082	DFSMS/VM	Indicates that the volume belongs to the VM category SCRATCH2

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Table 17 (Page 2 of 7). Library Manager Volume Categories		
Category (in hex)	**Used by**	**Definition**
0083	DFSMS/VM	Indicates that the volume belongs to the VM category SCRATCH3
0084	DFSMS/VM	Indicates that the volume belongs to the VM category SCRATCH4
0085	DFSMS/VM	Indicates that the volume belongs to the VM category SCRATCH5
0086	DFSMS/VM	Indicates that the volume belongs to the VM category SCRATCH6
0087	DFSMS/VM	Indicates that the volume belongs to the VM category SCRATCH7
0088	DFSMS/VM	Indicates that the volume belongs to the VM category SCRATCH8
0089	DFSMS/VM	Indicates that the volume belongs to the VM category SCRATCH9
008A	DFSMS/VM	Indicates that the volume belongs to the VM category SCRATCHA
008B	DFSMS/VM	Indicates that the volume belongs to the VM category SCRATCHB
008C	DFSMS/VM	Indicates that the volume belongs to the VM category SCRATCHC
008D	DFSMS/VM	Indicates that the volume belongs to the VM category SCRATCHD
008E	DFSMS/VM	Indicates that the volume belongs to the VM category SCRATCHE
008F	DFSMS/VM	Indicates that the volume belongs to the VM category SCRATCHF
0090 to 009F	-	Currently not assigned
00A0	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH00
00A1	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH01
00A2	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH02
00A3	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH03
00A4	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH04
00A5	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH05
00A6	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH06
00A7	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH07
00A8	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH08

Table 17 (Page 3 of 7). Library Manager Volume Categories

Category (in hex)	Used by	Definition
00A9	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH09
00AA	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH10
00AB	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH11
00AC	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH12
00AD	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH13
00AE	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH14
00AF	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH15
00B0	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH16
00B1	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH17
00B2	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH18
00B3	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH19
00B4	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH20
00B5	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH21
00B6	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH22
00B7	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH23
00B8	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH24
00B9	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH25
00BA	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH26
00BB	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH27
00BC	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH28
00BD	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH29
00BE	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH30
00BF	VSE/ESA	Indicates that the volume belongs to the VSE category SCRATCH31

Table 17 (Page 4 of 7). Library Manager Volume Categories		
Category (in hex)	**Used by**	**Definition**
00C0 to 00FF	-	Currently not assigned
0100	OS/400 (MLDD)	Indicates that the volume has been assigned to category *SHARE400. Volumes in this category can be shared between all attached AS/400 systems.
0101	OS/400 (MLDD)	Indicates that the volume has been assigned to category *NOSHARE. Volumes in this category can be accessed only by the OS/400 system that assigned it to the category.
0102 to 012B	-	Currently not assigned
012C	ADSM/6000	Indicates a private volume. Volumes in this category are managed by ADSM/6000.
012D	ADSM/6000	Indicates an IBM 3490 scratch volume. Volumes in this category are managed by ADSM/6000.
012E	ADSM/6000	Indicates an IBM 3590 scratch volume. Volumes in this category are managed by ADSM/6000.
012F to 0FEF	-	Currently not assigned
0FF0 to 0FF1	BTLS	Reserved
0FF2	BTLS	Indicates a scratch volume. Volumes in this category belong to the optional scratch pool SCRTCH2.
0FF3	BTLS	Indicates a scratch volume. Volumes in this category belong to the optional scratch pool SCRTCH3.
0FF4	BTLS	Indicates a scratch volume. Volumes in this category belong to the optional scratch pool SCRTCH4.
0FF5	BTLS	Indicates a scratch volume. Volumes in this category belong to the optional scratch pool SCRTCH5.
0FF6	BTLS	Indicates a scratch volume. Volumes in this category belong to the optional scratch pool SCRTCH6.
0FF7	BTLS	Indicates a scratch volume. Volumes in this category belong to the optional scratch pool SCRTCH7.
0FF8	BTLS	Indicates a scratch volume. Volumes in this category belong to the optional scratch pool SCRTCH8.
0FF9 to 0FFE	BTLS	Reserved

Table 17 (Page 5 of 7). Library Manager Volume Categories

Category (in hex)	Used by	Definition
0FFF	BTLS	Indicates a scratch volume. Volumes in this category belong to the default scratch pool used by BTLS. **Note:** If you are planning to migrate to DFSMS/MVS, you should use this default scratch category only.
1000 to F00D	-	Currently not assigned
F00E	BTLS	Indicates a volume in error. Volumes are assigned to the error category during demount if the volume serial specified for demount does not match the external label of the volume being demounted.
F00F to FEFF	-	Currently not assigned
FF00	All	Indicates Insert. Set when a tape volume is added to the inventory. The vision system reads the external label on the volume, and the Library Manager creates an inventory entry for the volume and assigns it to this category. The attached hosts are notified when one or more volumes are assigned to this category.
FF01 to FF0F	-	Reserved
FF10	Library Manager	Indicates Convenience eject. Set when the Library Manager accepts an eject request. The volume becomes eject pending and is queued to be moved to the convenience output station. When the cartridge accessor delivers the volume to the output station, it is deleted from the Library Manager′s inventory.
FF11	Library Manager	Indicates Bulk eject. Set when the Library Manager accepts an eject request. The volume becomes eject pending and is queued to be moved to the high capacity output station. When the cartridge accessor delivers the volume to the output rack, it is deleted from the Library Manager′s inventory.
FF12 to FFF8	-	Reserved

Table 17 (Page 6 of 7). Library Manager Volume Categories

Category (in hex)	Used by	Definition
FFF9	Library Manager	Indicates a service volume. Set when the Library Manager detects that a volume has a unique service cartridge volume serial. Volume serials that fit in the mask *CE xxx* (where xxx represents any valid volume serial characters) are service cartridges. Specific cell locations (defined during the teach process) are reserved for service cartridges. The hosts do not have a record of volumes in the service volume category. Volumes in this category are not reported in inventory data in response to a request from the host.
FFFA	Library Manager	Indicates Manually ejected. Assigned to this category if the cartridge was not found but in the inventory.
FFFB	Library Manager	Indicates Purge Volume. Used only with the 3494. When it notices during an Inventory Update that volumes have been removed since its last update, it places such volumes in the Manually-Ejected category. Hosts can list such volumes and assign them (temporarily) to this Purge-volume category. This action deletes their database entries in the Library Manager.
FFFC	Library Manager	Indicates Unexpected Volume. Reserved for future use.
FFFD	Library Manager	Indicates a cleaner cartridge for the 3590 tape drive. Assigned to this category when the cleaner volumes are identified by the Library Manager. Cleaner volumes are recognized when their volume serial matches a mask set up by the operator through the Library Manager console. Cleaner volumes with the character J on the seventh position of the external volume label are assigned to this category. The hosts do not have a record of volumes in the cleaner volume category. Volumes in this category are not reported in inventory data in response to a request from the host.
FFFE	Library Manager	Indicates a cleaner cartridge for IBM 3490 drives. Assigned to this category when the cleaner volumes are identified by the Library Manager. Cleaner volumes are recognized when their volume serial matches a mask set up by the operator through the Library Manager console. Cleaner volumes without the character J on the seventh position of the external volume label are assigned to this category. The hosts do not have a record of volumes in the cleaner volume category. Volumes in this category are not reported in inventory data in response to a request from the host.

Table 17 (Page 7 of 7). Library Manager Volume Categories

Category (in hex)	Used by	Definition
FFFF	All except DFSMS/MVS	Indicates a private volume. Set by the control program. Any tape mount request to this category must be for a specific volume serial, not based on the category only.

Appendix B. The IBM Magstar Virtual Tape Server

The IBM Magstar Virtual Tape Server, integrated with the IBM Tape Library Dataservers, delivers an increased level of storage capable to the traditional storage products hierarchy. The host software sees Virtual Tape Server subsystem as a 3490 Enhanced Capability (3490E) Tape Subsystem with associated standard (CST) or Enhanced Capacity Cartridge System Tapes (ECCST). This virtualization of both the tape devices and the storage media to the host allows for transparent utilization of the capabilities of the IBM 3590 tape technology.

In this chapter, we present the IBM Magstar Virtual Tape Server and cover the following topics:

- We introduce and give you a brief overview of the key attributes and the general concept of the Virtual Tape Server subsystem.
- We describe the hardware components and building blocks and list the supporting host software products.

Note: For details about implementation considerations and data flow as well as for migration and operational considerations, please refer to Redbook, *The IBM Magstar Virtual Tape Server and Enhancements to Magstar: New Era in Tape*.

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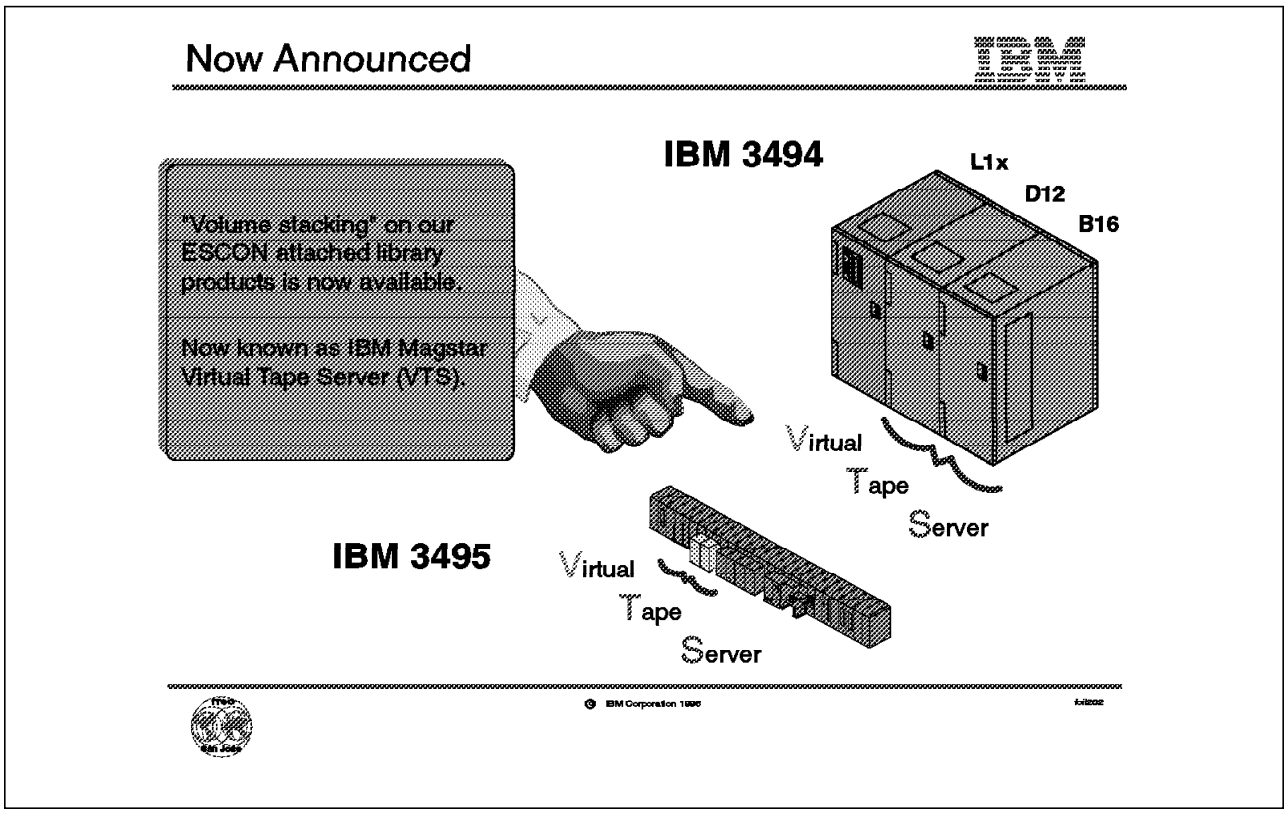

Figure 82. Now Announced the IBM Magstar Virtual Tape Server

B.1 Now Announced the IBM Magstar Virtual Tape Server

In April 1995, together with the announcement of the IBM Magstar 3590 High Performance Tape Subsystem, IBM announced a statement of direction to deliver capacity-enabling technology (also called volume stacking) on our ESCON-attached library products.

Fulfilling this statement of direction, IBM now announces the IBM Magstar Virtual Tape Server (VTS) for IBM 3494 and 3495 Tape Libraries.

B.1.1 Virtual Tape Server for IBM 3494 Tape Library

The Virtual Tape Server subsystem in an IBM 3494 is composed of:

- One IBM 3494-D12 drive unit frame houses the IBM 3590-B1A tape drives that are dedicated to the Virtual Tape Server function.
- One IBM 3494-B16 Virtual Tape Server unit frame which contains the required hardware and microcode to enable full 3590 Magstar tape storage capacity, plus cartridge storage cells.

Figure 82 shows the minimum configuration of a Virtual Tape Server subsystem in IBM 3494 Tape Library including one library unit frame, one drive unit frame, and one Virtual Tape Server unit frame.

B.1.2 Virtual Tape Server for IBM 3495 Tape Library

Installed in an IBM 3495 Tape Library, the Virtual Tape Server subsystem is composed of:

- One IBM 3590-A14 frame that houses four IBM 3590-B1A tape drives which are dedicated to the Virtual Tape Server function. No IBM 3590-A00 ESCON tape controller is required.
- One IBM 3495-B16 Virtual Tape Server unit frame that contains the required hardware and microcode to enable full tape storage capacity.

Figure 82 on page 186 shows the smallest Virtual Tape Server subsystem in an IBM 3495 Tape Library configuration consisting of an IBM 3495 Tape Library Model L20, including the IBM Magstar Virtual Tape Server.

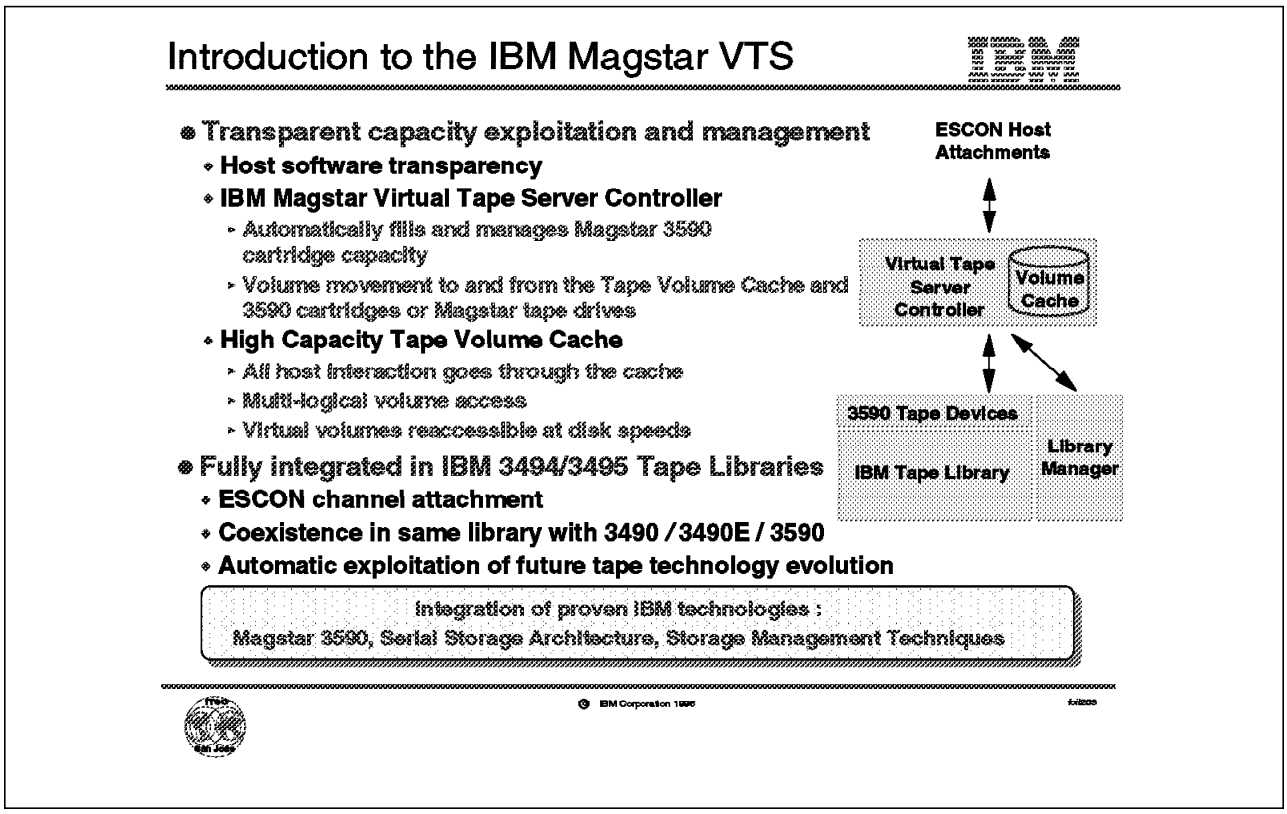

Figure 83. Introduction to the IBM Magstar Virtual Tape Server

B.2 Introduction to the IBM Magstar Virtual Tape Server

The IBM Magstar Virtual Tape Server Controller, Tape Volume Cache, and the IBM 3590 Magstar tape drives, together with the required housing, make up the IBM Magstar Virtual Tape Server subsystem, allowing automatic utilization of the Magstar cartridge storage capacity and the drive data rate of 9 MB/s.

B.2.1 Transparent Capacity Exploitation and Management

The IBM Magstar Virtual Tape Server automatically fills the 30 GB Magstar 3590 cartridge. This is completed by the built-in storage management functions and is transparent to any software, whether operating system or third-party program.

B.2.1.1 Host Software Transparency

The operating system knows only about tape drives and volumes and does not need to manage the storage of virtual and stacked volumes. Therefore, in most installations you do not need to change your operating system software at all.

B.2.1.2 IBM Magstar Virtual Tape Server Controller

The IBM Magstar Tape Server Controller and its associated microcode, are the key components of the Virtual Tape Server subsystem:

- It automatically fills and manages Magstar 3590 cartridge capacity.
- It controls and manages the volume movement to and from the tape volume cache and 3590 cartridges or Magstar tape drives.

B.2.1.3 High Capacity Tape Volume Cache

The Tape Volume Cache (TVC) is the disk component of the Virtual Tape Server subsystem. It is used to buffer virtual volumes created by the host before they are written to the physical IBM 3590 tape devices. It has these advantages:

- All host interaction is through the Tape Volume Cache. The operating system sees 32 virtual tape devices which are physically represented by storage space on the Tape Volume Cache's RAID (Redundant Array of Independent Disk) DASD. The operating system cannot directly write a logical volume to a stacked Magstar cartridge.
- Multiple virtual volumes can be accessed in parallel because they physically reside on the DASD.
- Virtual volumes are reacessible at disk speeds. Tape motion commands such as space, locate, rewind, and unload are mapped into disk commands and happen in milliseconds, not seconds as for traditional tape commands.

B.2.2 Fully Integrated in IBM 3494 and IBM 3495 Tape Libraries

The IBM Magstar Virtual Tape Server can only be installed inside an IBM 3494 or 3495 Tape Library, and is fully supported through the Library Manager. For instance, the location of virtual volumes and physical Magstar cartridges is stored in the Library Manager console. Logical and physical volume serial ranges are defined at the Library Manager console.

B.2.2.1 ESCON Channel Attachment

The IBM Magstar Virtual Tape Server is attached to the host through ESCON channels, allowing two simultaneous ESCON data transfers.

B.2.2.2 Coexistence in Same Library with IBM 3490, 3490E or 3590

The IBM Magstar Virtual Tape Server can be installed in an IBM 3495 with IBM 3490, 3490E, and 3590 tape drives. Inside an IBM 3494, the IBM Magstar Virtual Tape Server can be installed together with IBM 3490E, and ESCON- and SCSI-attached IBM 3590 tape drives. This ensures investment protection and ease of migration.

B.2.2.3 Automatic Exploitation for Future Tape Technology Evolutions

The concept of the IBM Magstar Virtual Tape Server allows for immediate utilization of future enhancements to the IBM 3590 tape technology without impact to the host software.

B.2.3 Integration of Proven IBM Technologies

The IBM Magstar Virtual Tape Server is built using proven IBM technologies. The Virtual Tape Server controller, for example, is based on RISC technology

B.2.3.1 Magstar 3590

These are the industry's leading half-inch tape drives for performance, capacity, and reliability. Over 7,000 IBM 3590 tape drives have been shipped since general availability in September 1995.

B.2.3.2 Serial Storage Architecture

Serial Storage Architecture (SSA), together with high-performance disks, provides improved performance and availability over previous-generation disk architecture.

B.2.3.3 Storage Management Techniques

The storage management techniques are built on over 20 years of IBM experience; they use for example, many features and functions found in IBM′s industry-leading DFSMShsm and ADSM software products.

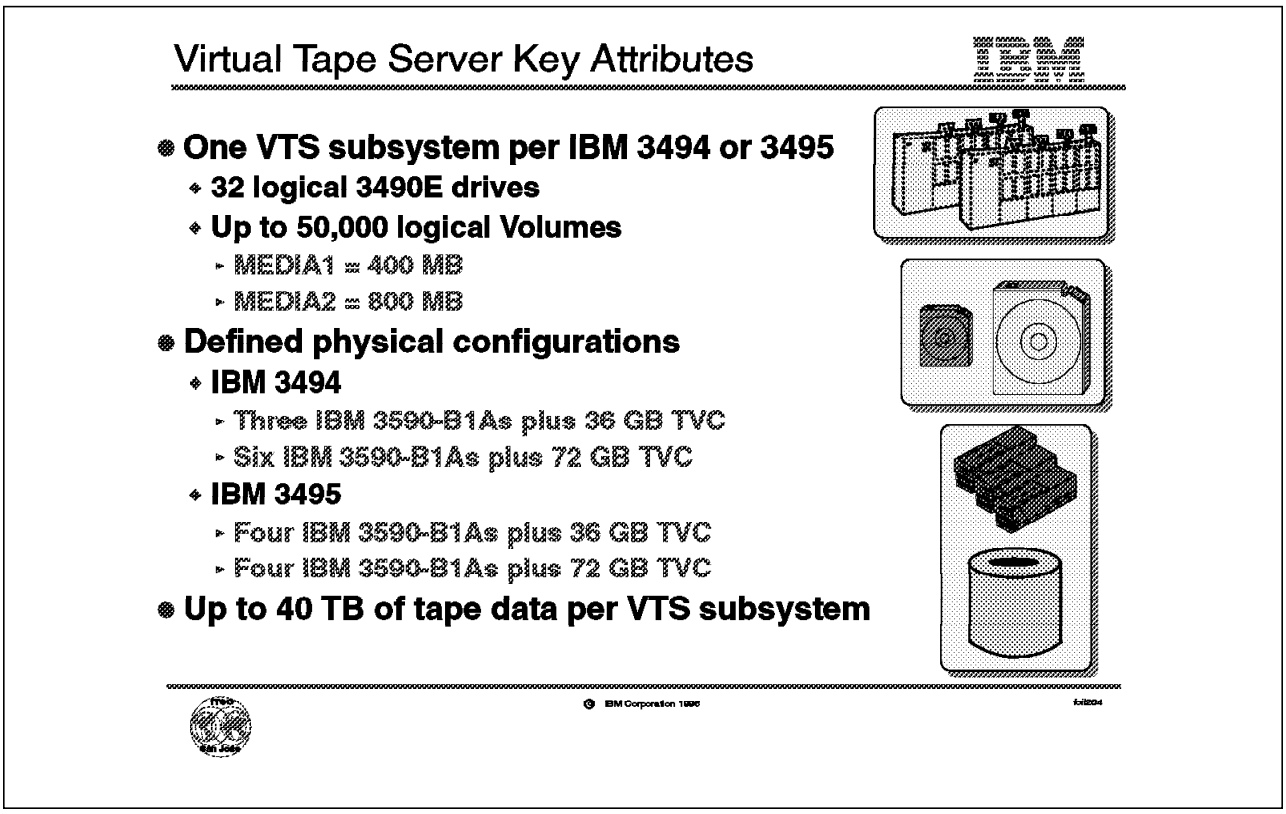

Figure 84. Virtual Tape Server Key Attributes

B.3 Virtual Tape Server Key Attributes

Figure 84 lists the logical and physical key attributes of the IBM Magstar Virtual Tape Server.

B.3.1 One VTS Subsystem per IBM 3494 or IBM 3495

Currently, one Virtual Tape Server subsystem can be installed in a single IBM 3494 or 3495 tape library. The Virtual Tape Server subsystem can be integrated into an existing automated tape library in addition to, or instead of, already installed physical tape drives. VTS tape drives can be shared across different platforms and Sysplexes, just like any other IBM 3490E subsystem can in our libraries. For details of the installation requirements, please refer to Figure 89 on page 205 through Figure 95 on page 217.

B.3.1.1 Number of Logical 3490E Tape Drives

Before this announcement, no more than sixteen IBM 3490E tape drives could be installed in a single IBM 3494 tape library or an IBM 3495-L20.

Each Virtual Tape Server subsystem presents itself to the host as 32 3490E tape drives, thus allowing much more parallelism in tape processing. Because of the large number of logical tape drives, more drives can now be dedicated to different hosts and platforms. In most cross-platform installations, dynamic and automatic sharing of tape drives may no longer be required, although the Virtual Tape Server fully supports existing tape drive sharing methods.

B.3.1.2 Up to 50,000 Logical Volumes

A single Virtual Tape Server subsystem can manage up to 50,000 logical 3490E volumes, making even a small tape library look very large. We describe logical volumes in detail in Section B.4, “Virtual Tape Server Key Concepts” on page 194.

Logical volumes are defined through the Library Manager console and can have two different sizes:

- MEDIA1=400 MB

  MEDIA1 reflects a CST type of cartridge written in 36-track recording technology without using the Improved Data Recording Capability (IDRC) that a physical IBM 3490E tape drive provides.

- MEDIA2=800 MB

  MEDIA2 reflects an ECCST type of cartridge written in 36-track recording technology without using the IBM 3490E′s IDRC.

Logical 3490E volumes are stacked on physical Magstar cartridges allowing effective use of their large capacity of +30 GB and of the IBM 3590 tape drive′s excellent performance.

The number of stacked Magstar 3590 physical cartridges managed by the IBM Magstar Virtual Tape Server is limited only by the number of storage slots inside your IBM 3494 or 3495 tape library.

B.3.2 Defined Physical Configurations

Regardless of the physical Virtual Tape Server configuration, the logical attributes such as the number of virtual drives and volumes remain the same as listed above.

B.3.2.1 IBM 3494

The Virtual Tape Server in an IBM 3494 is supported in two configurations at general available time according to the number of physical IBM 3590-B1A tape drives and Tape Volume Cache storage capacity:

- Three IBM 3590-B1As plus 36 GB of Tape Volume Cache

  If your tape operation is inhibited by the number of tape drives available but not in terms of throughput, you might consider installing this configuration.

- Six IBM 3590-B1As plus 72 GB of Tape Volume Cache

  This configuration is the maximum configuration for a Virtual Tape Server subsystem in an IBM 3494.

More configurations are being tested; support for these will be announced at the completion of testing. Some of the configurations being tested are four- and five-drive configurations.

B.3.2.2 IBM 3495

An IBM 3590-A14 frame included in a IBM 3495 tape library must always contain four IBM 3590-B1A tape drives. Because the IBM 3590-B1As used by the Virtual Tape Server are installed in an IBM 3590-A14 frame, the following two configurations are available:

- Four IBM 3590-B1As plus 36 GB of Tape Volume Cache

- Four IBM 3590-B1As plus 72 GB of Tape Volume Cache

B.3.3 Up to 40 TB of Tape Data per Virtual Tape Server Subsystem

The IBM Magstar Virtual Tape Server introduces new dimensions for managing tape data. Instead of wasting tape storage capacity by not effectively utilizing the full length of a tape cartridge, the IBM Magstar Virtual Tape Server occupies only the amount of tape storage necessary to store the number of bytes written by a host application. For instance, a tape data set of 200 MB which is written to a virtual 3490E MEDIA2 cartridge will occupy only 200 MB on the Tape Volume Cache and on the stacked Magstar cartridge and not use the possible 800 MB.

Defining the maximum number of logical volumes using MEDIA2 only, and making full use of their 800 MB capacity, allows you to store up to 40 TB of tape data in a single Virtual Tape Server subsystem.

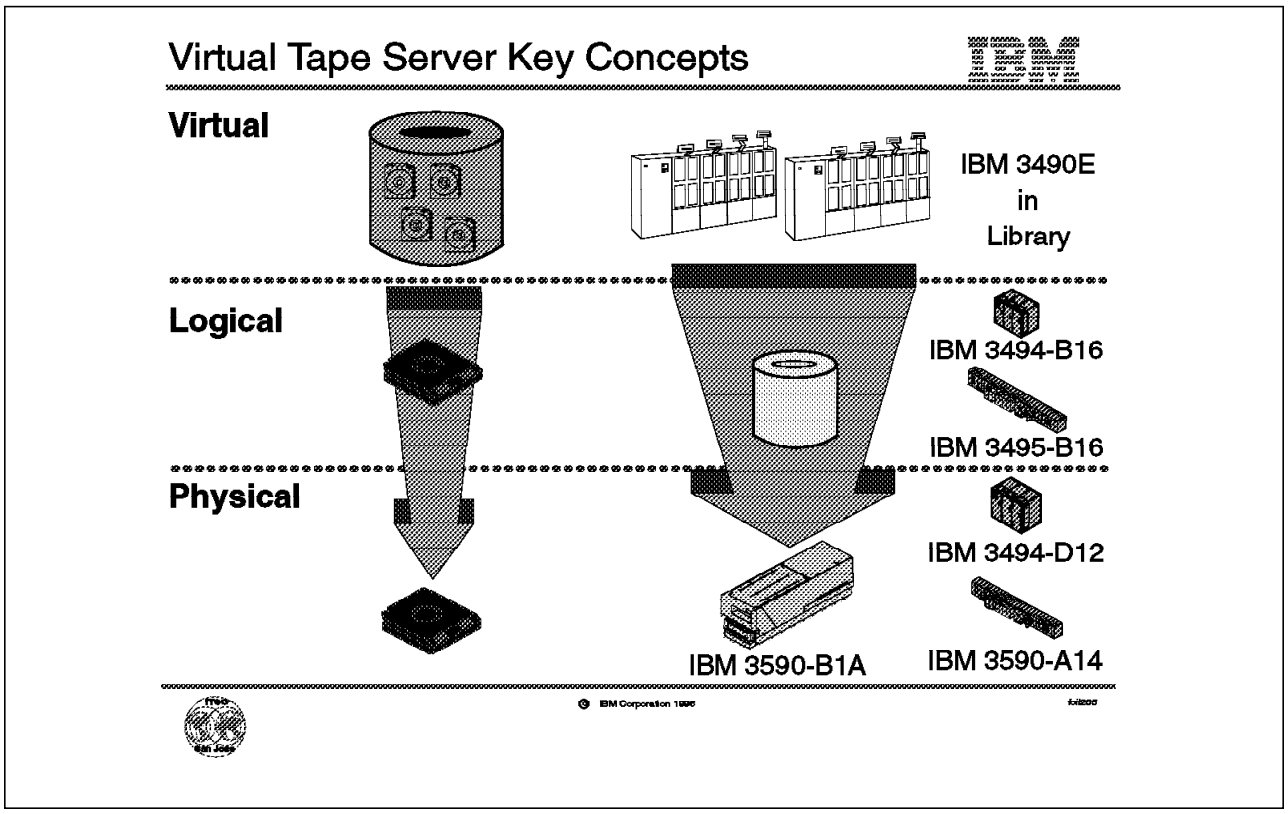

Figure 85. Virtual Tape Server Key Concepts.

B.4 Virtual Tape Server Key Concepts

Along with introducing the IBM Magstar Virtual Tape Server, we introduce new views of volumes and devices because of the different knowledge about volumes and devices in the host system and the hardware. Using a Virtual Tape Server subsystem, the host application writes tape data to virtual devices. The volumes created by the hosts are called Virtual Volumes and are physically stored in a tape volume cache which is built from RAID DASD.

Through tape volume cache management policies, the virtual tape server management software moves host-created volumes from the Tape Volume Cache to a Magstar cartridge managed by the Virtual Tape Server subsystem. Once a virtual volume is moved from the Tape Volume Cache to tape, it becomes a logical volume.

To allow software transparency and implementation of a Virtual Tape Server subsystem with no changes to the host's operating system software, the host has only a virtual view of the volumes and tape drives managed by the Virtual Tape Server subsystem. The host cannot distinguish physical from virtual volumes or their respective tape drives and will treat them as if they were "real" cartridges and devices.

Management of physical Magstar tape drives and Magstar cartridges is completely under control of the VTS storage management software.

B.4.1 Virtual Volumes

When the host application writes tape data to the IBM Magstar Virtual Tape Server, a virtual volume is created. Virtual volumes are physically stored in the Tape Volume Cache and all host commands are issued to the virtual volume residing on DASD. All host interaction with tape data in a Virtual Tape Server subsystem is through virtual volumes and through virtual tape devices.

Each virtual volume has the following characteristics (just like a real volume):

- It has a unique volume serial (volser) number known to the host.
- It is loaded and unloaded on a virtual device.
- It supports all tape write modes, including Tape Write Immediate.
- It contains all standard tape marks and data blocks.
- It supports an IBM standard label.
- It can be appended to after it was initially written from the beginning of tape.
- Data written is guaranteed to be in the Tape Volume Cache when a command is completed successfully that either implicitly or explicitly causes synchronization.
- Each host written record has a logical block ID.
- End of volume is signaled when the total number of bytes written has reached 400 MB for an emulated CST or 800 MB for an emulated ECCS T volume.

Virtual volumes can exist only in an IBM 3494 or 3495 tape library. You can direct a tape data set to a virtual tape drive by directing it into a specific tape library.

B.4.2 Virtual Devices

From a host perspective, the Virtual Tape Server subsystem looks like two IBM 3490E tape control units, each with 16 devices attached through ESCON channels. Virtual tape drives are defined just like physical IBM 3490-A10 controller with 16 addresses through HCD (Hardware Configuration Definition), or through IOCP (I/O Configuration Program), and MVSCP or HCPRIO macro. However, you should not define a preferred path for the virtual devices.

An IOCP example of two VTS strings has been included showing the virtual drives configured using the CUADD statements:

```
                    Virtual Tape Server IOCP

                    9032 - PORT D6 = CHPID'S 29 & 32
                    9032 - PORT D7 = CHPID'S 2A & 35
 *
          CNTLUNIT  CUNUMBR=32E,PATH=(32,29),UNIT=TAPE,                X
                UNITADD=((00,16)),LINK=(D6,D6),CUADD=0
          CNTLUNIT  CUNUMBR=35E,PATH=(35,2A),UNIT=TAPE,                X
                UNITADD=((00,16)),LINK=(D7,D7),CUADD=0
 TAPE1AE0 IODEVICE ADDRESS=(1AE0,16),UNIT=TAPE,CUNUMBR=(32E,35E),      X
                UNITADD=00
 *
          CNTLUNIT  CUNUMBR=32F,PATH=(32,29),UNIT=TAPE,                X
                UNITADD=((00,16)),LINK=(D6,D6),CUADD=1
          CNTLUNIT  CUNUMBR=35F,PATH=(35,2A),UNIT=TAPE,                X
```

```
                UNITADD=((00,16)),LINK=(D7,D7),CUADD=1
TAPE1AF0 IODEVICE ADDRESS=(1AF0,16),UNIT=TAPE,CUNUMBR=(32F,35F),       X
                UNITADD=00
```

Each virtual device has the following characteristics (just like real tape devices):

- It has a host device address.
- It is included in the I/O generation for the system.
- It is varied online or offline to the host.
- It signals ready when a virtual volume is loaded.
- It responds and processes all IBM 3490E I/O commands
- It becomes not ready when a virtual volume is rewound and unloaded.

The functionality of the 3490E Integrated Cartridge Loader (ICL) is also included in the virtual device′s capability. All virtual devices indicate that they have an ICL. You can associate a media type with the cartridge loader that will allow fast access for scratch mounts. The active status of the cartridge loader depends on the availability of scratch volumes of the assigned media type.

B.4.3 Logical Volumes

When a virtual volume is moved from the Tape Volume Cache, the process is called Destaging, and the volume becomes a logical volume. When a logical volume is moved from a Magstar cartridge to the Tape Volume Cache, the process is called staging and the volume becomes a virtual volume again.

As virtual volumes are moved from the Tape Volume Cache to a Magstar cartridge, they are stacked on the cartridge end to end, taking up only the number of bytes written by the host, thereby effectively utilizing all of the cartridge′s storage capacity.

You define the volume serial numbers for the logical volumes through the Library Manager console. The Library Manager console associates a Fast-Ready attribute with the category that the volume serial numbers are defined within. The Library Manager assigns the logical volumes to the insert category and notifies all attached hosts. Subsequent host inventory processing is performed as for physical CST and ECCST volumes.

Because a logical volume resides on a physical cartridge together with many other logical volumes, the library containing virtual and logical volumes must be treated as a closed store. This means that you can move the data on the volumes electronically but not physically.

Note: Currently, stacked Magstar cartridges cannot be removed from the IBM Magstar Virtual Tape Server. Therefore, these cartridges cannot be ejected from the tape library.

B.4.4 Physical Volumes

The physical Magstar cartridges used by the IBM Magstar Virtual Tape Server to store logical volumes are totally under the control of the Virtual Tape Server subsystem and are not known to the hosts. The physical volume is also called “stacked volume.” However, they must have unique volume serial numbers like any other cartridge in a tape library.

Through the Library Manager console, you define which cartridges are to be used by the Virtual Tape Server subsystem. Logical volumes are mapped by the internal storage management software.

B.4.5 Physical Devices

The physical Magstar tape drives installed in the IBM Magstar Virtual Tape Server are invisible to any attached host system. They are completely under the control of the Virtual Tape Server subsystem and therefore cannot be addressed by any host system.

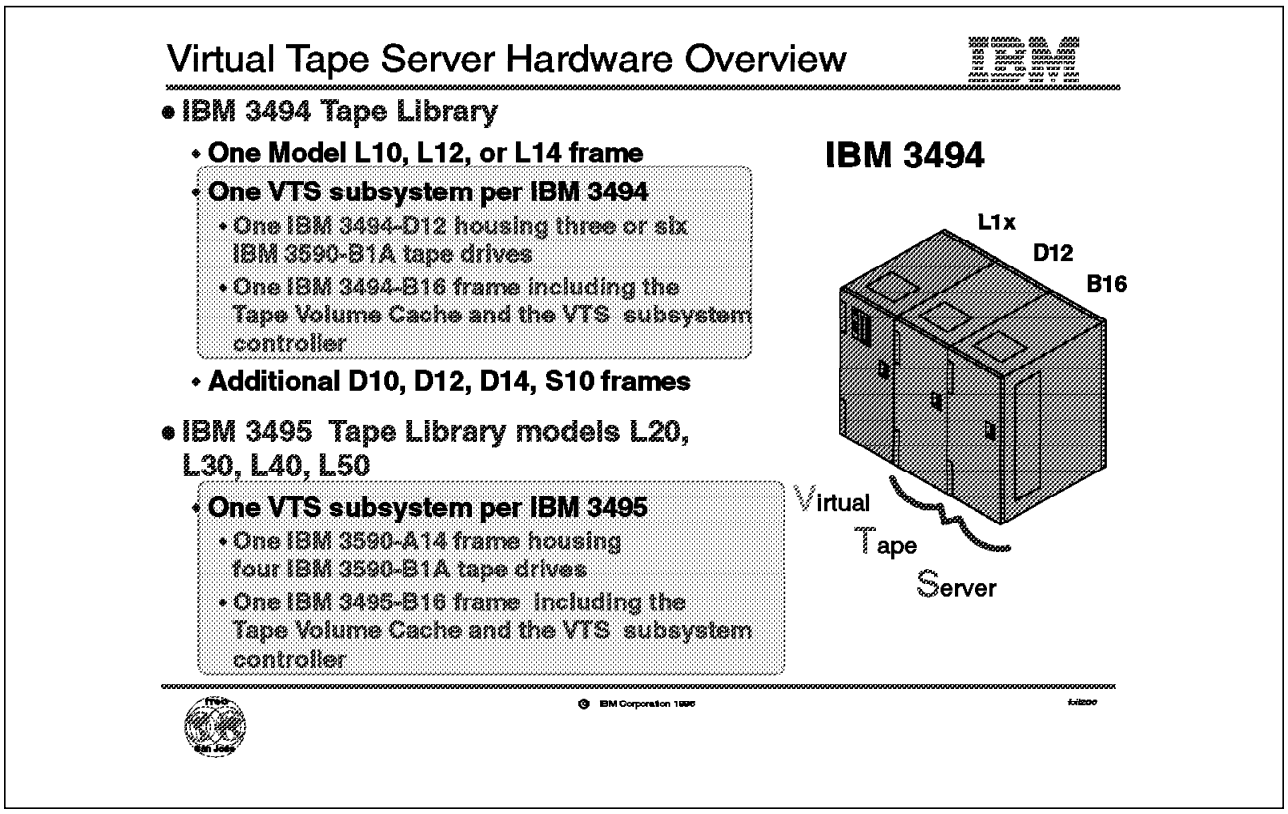

Figure 86. Hardware Overview

B.5 Hardware Overview

This section describes hardware overview for Virtual Tape Server.

B.5.1 IBM 3494 Tape Library

An IBM 3494 Tape Library offers great configuration granularity because it is made up of frames of identical size.

An IBM 3494 Tape Library including the IBM Magstar Virtual Tape Server is composed of the hardware frames discussed below.

B.5.1.1 One IBM 3494 Model L10, L12, or L14 Control Unit Frame

An IBM 3494 must include one library control-unit frame which contains the Library Manager, the convenience I/O station (optional), and up to two tape drives:

- IBM 3490E-CxA tape drives with an integrated controller in the IBM 3494-L10
- SCSI-attached IBM 3590-B1A tape drives in the IBM 3494-L12
- ESCON-attached IBM 3590-B1A tape drives and the IBM 3590-A00 controller in the IBM 3494-L14.

The IBM 3494-L12 and IBM 3494-L14 library control unit frame can be installed without drives. For an IBM 3494-L10 frame, you must submit a Request for Price Quotation (RPQ).

B.5.1.2 One VTS Subsystem per IBM 3494

Currently, only one Virtual Tape Server subsystem can be installed in each IBM 3494 tape library. The IBM Magstar Virtual Tape Server is made up of the following components:

- One IBM 3494-D12 drive frame housing three or six IBM 3590-B1As

  These IBM 3590-B1As are for exclusive use of the IBM Magstar Virtual Tape Server. They are attached only to the Virtual Tape Server controller, which is installed in the IBM 3494-B16 frame, and are therefore not visible to any attached host. No additional tape drives that directly attach to any host can be installed inside an IBM 3494-D12 frame owned by the Virtual Tape Server.

  When ordering an IBM 3494-D12 frame, you must order the tape drives separately, as you would for non-VTS-attached IBM 3494-D12 frames.

  The IBM 3494-D12 frame provides 290 cartridge storage cells. The occupancy of the storage cells is under control of the Library Manager. Therefore, these storage cells can be used by the Library Manager to store any physical cartridge, not only those belonging to the Virtual Tape Server subsystem.

- One IBM 3494-B16 frame including the tape volume cache and the VTS subsystem controller

  If you open the door of an IBM 3494-B16 frame, you will notice that it looks almost like an IBM 3494-S10 storage unit frame from the inside. This is because the IBM 3494-B16 frame provides storage capacity for 400 cartridges as well as containing the hardware and software components of the Virtual Tape Server. As in the Virtual Tape Server-owned IBM 3494-D12 frame, these storage cells can also contain cartridges that do not belong to the Virtual Tape Server subsystem.

B.5.1.3 Additional IBM 3494 Model D10, D12, D14, or S10 Frames

An IBM 3494 tape library can be composed of up to 16 frames. An additional 13 frames can be added, consisting of drive unit frame IBM 3494-D10/D12/D14 and storage unit frame IBM 3494-S10.

B.5.2 IBM 3495 Tape Library Models L20, L30, L40, L50

The IBM Magstar Virtual Tape Server is integrated in an IBM 3495 tape library by attaching two frames to either model, similar to adding two IBM 3590-A14 frames or a combination of one IBM 3490-A20 tape control unit and one IBM 3490-B40 tape drive box.

B.5.2.1 One Virtual Tape Server Subsystem per IBM 3495

At this time, only one Virtual Tape Server subsystem can be added to an IBM 3495 tape library. The Virtual Tape Server consists of:

- One IBM 3590 tape subsystem Model A14 frame, housing four Magstar tape drives Model B1A.

  The IBM 3590-A14 frame for integration in a Virtual Tape Server does not include the IBM 3590-A00 controller. You must order the IBM 3590-B1A tape drives separately.

  The IBM 3590-B1A tape drives are not accessible by any host system and are for exclusive use of the Virtual Tape Server. All of the tape drives in the IBM 3590-A14 are dedicated to the Virtual Tape Server subsystem and cannot directly attach to a host system instead.

- One IBM 3495-B16 Virtual Tape Server unit frame including the Tape Volume Cache and the VTS subsystem controller.

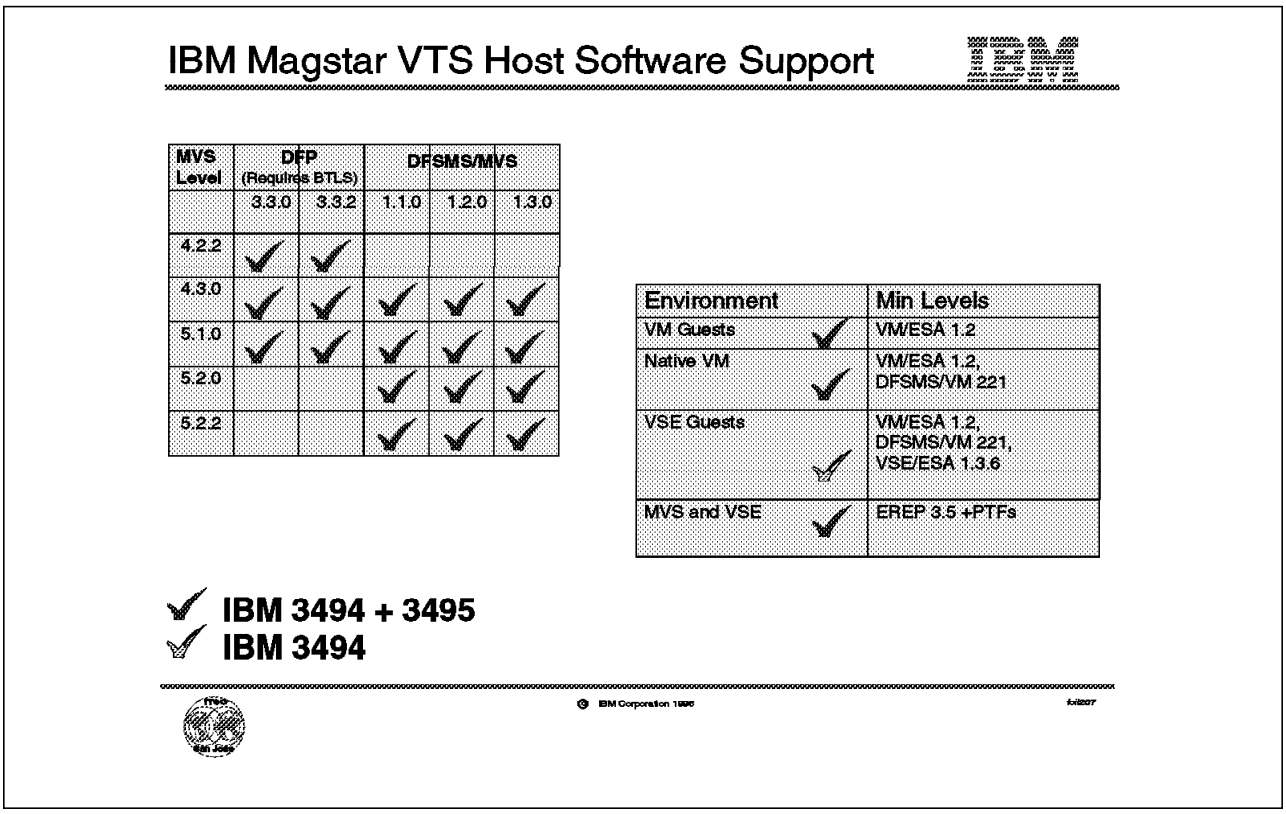

Figure 87. IBM Magstar Virtual Tape Server Host Software Support

B.6 IBM Magstar Virtual Tape Server Host Software Support

The IBM Magstar Virtual Tape Server appears to the host as two fully configured IBM 3490E tape subsystems. The software support is thus the same in the environments described below whether for a Virtual Tape Server subsystem included in IBM 3494 or one in IBM 3495.

B.6.1 MVS/ESA

The table on the left hand-side of Figure 87 shows the software requirements in an MVS/ESA environment.

In a system-managed tape environment, the following software levels are supported:

- MVS/ESA V4.3.0, V5.1.0, or V5.2.0
- JES3 Version V4.2.1, V5.1.1 or V5.1.2, if installed
- DFSMS/MVS V1.1.0, V1.2.0, or V1.3.0
- Environmental Record Editing and Printing (EREP) V3.5 plus PTF

If you are managing your IBM 3494 or 3495 tape library using Basic Tape Library Support (BTLS) for MVS/DFP (5655-057), the following software levels are supported:

- MVS/ESA V4.2.2, V4.3.0, or V5.1.0
- MVS/DFP V3.3.0 or V3.3.2

- EREP V3.5 plus program temporary fix (PTF)

If you are using BTLS for DFSMS/MVS (5655-056), the following software levels are required:

- MVS/ESA V4.3.0 or V5.1.0
- DFSMS/MVS V1.1.0, V1.2.0, or V1.3.0
- EREP V3.5 plus PTF

If you are using other 3490E emulations, such as Magstar tape drives attached to the host through the IBM 3591-A01 controller, you must install BTLS to allow the host to distinguish between native and emulated IBM 3490E devices.

B.6.2 VM/ESA

In a native VM/ESA environment, the Virtual Tape Server requires the following software levels:

- VM/ESA V1.2 or higher
- DFSMS/VM Function Level 221

For guest operating system support, VM/ESA V1.2. or higher must be installed, but DFSMS/VM is not required.

B.6.3 VSE/ESA

Native VSE/ESA does not support the IBM Magstar Virtual Tape Server. If VSE/ESA is running as a guest under VM, the following software levels are required for support of a Virtual Tape Server subsystem installed in an IBM 3494 tape library:

- VSE/ESA V1.3.5 or higher plus PTFs
- EREP V3.5 plus PTFs

Please note that the IBM Magstar Virtual Tape Server in a IBM 3495 tape library is not supported for VSE/ESA, either native or running as a guest under VM.

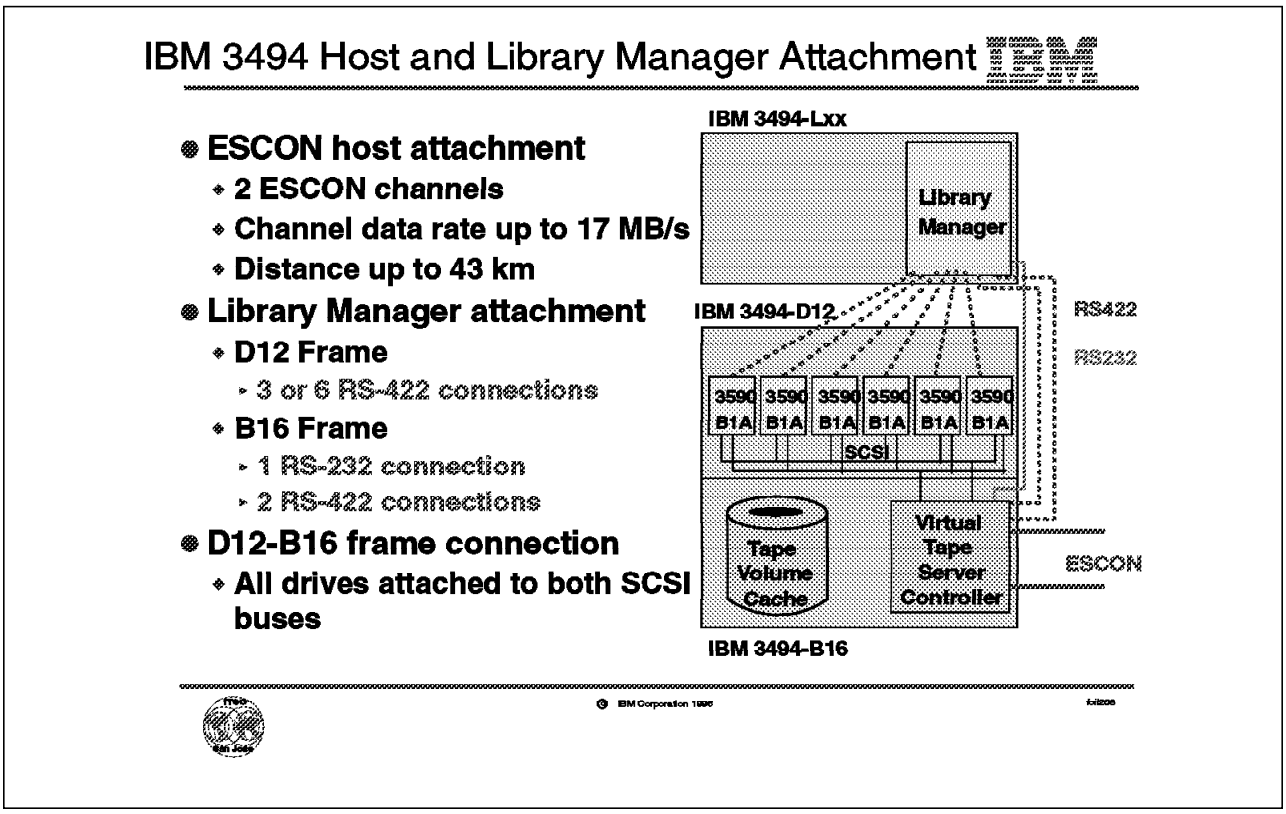

Figure 88. IBM 3494 Host and Library Manager Attachment

B.7 IBM 3494 Host and Library Manager Attachment

In Figure 88, we outline the integration of a Virtual Tape Server subsystem into an automated tape library through its attachments to the host and the Library Manager for an IBM 3494 tape library.

B.7.1 ESCON Host Attachment

The Virtual Tape Server subsystem is attached to the host through two ESCON channels, each providing 64 logical paths. Thus, the subsystem provides 128 logical paths in total.

Each ESCON channel provides a channel data rate of 17 MB/s instantaneous.

The Virtual Tape Server subsystem can be installed at the same distance of 43 km from the host as native Magstar tape drives.

All 32 virtual tape drives can be addressed through either ESCON channel.

B.7.2 Library Manager Attachment

The IBM 3590-B1A tape drives residing in the IBM 3494-D12 frame are not attached to any host system. They are attached solely to the Library Manager through an RS-422 connection to provide the required communication path for library-related commands, and to the Virtual Tape Server controller IBM 3494-B16.

The Virtual Tape Server controller is connected to the Library Manager through one RS-232 connection and two RS-422 connections to provide the required communication paths.

A total of five or eight RS-422 connections are required, depending on the number of Magstar tape drives installed in the Virtual Tape Server plus one RS-232 connection.

Without additional features installed on the library control-unit frame Models L10, L12, or L14, the library manager provides four RS-232 direct-attached host ports and four RS-422 control-unit or direct-attached drive connections. Currently, you need to order additional features for the IBM 3494 Model Lxx frames to provide the required Library Manager connections to the Virtual Tape Server subsystem.

Depending on the number of IBM 3590-B1A tape drives in the Virtual Tape Server controller (IBM 3494-B16) configuration and whether other control unit are installed in the IBM 3494, Feature 5229 and one or two Feature 5228 may need to be installed.

- If the IBM 3494-B16 contains three IBM 3590-B1A tape drives, up to an additional seven control units can be connected to the Library Manager with appropriate Features 5229 and 5228.
- If the IBM 3494-B16 contains six IBM 3590-B1A tape drives, up to an additional four control units can be connected to the Library Manager with appropriate Features 5229 and 5228.

B.7.3 IBM 3494-D12 and IBM 3494-B16 Frame Connections

All IBM 3590-B1A tape drives installed in the IBM 3494-D12 frame are connected to both SCSI buses of the Virtual Tape Server controller IBM 3494-B16. Because of this connection, both frames must be installed adjacent to one another.

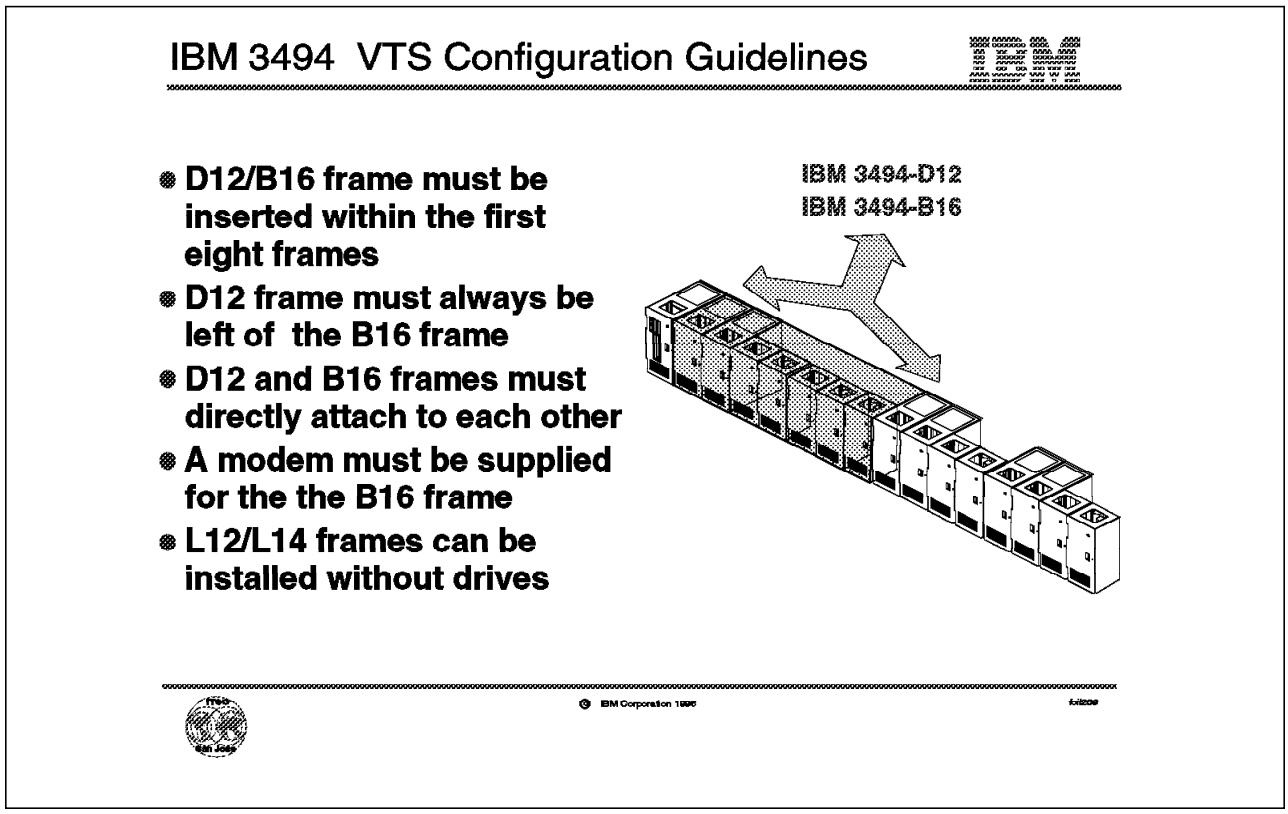

Figure 89. IBM 3494: VTS Configuration Guidelines

B.8 IBM 3494 Virtual Tape Server Configuration Guidelines

For physical configuration of an IBM 3494 Tape Library including the Virtual Tape Server, five basic configuration rules apply.

B.8.1 The L12/L14 Frame Can Be Without Drives

For a minimum configuration of an IBM 3494 with a Virtual Tape Server subsystem, the L12 or L14 frame can be installed without tape drives. Please submit an RPQ if you want to install a Model L10 frame without tape drives.

B.8.2 The D12/B16 Frame Must Be Within The First Eight Frames

If you are extending your current library to more than eight frames, you cannot install the Virtual Tape Server subsystem beyond the eighth frame.

If the configuration of frames in an installed IBM 3494 tape library has to be changed — for example, if frames must be moved to install a VTS subsystem, or if frames are moved from one IBM 3494 to another — an RPQ must be processed before the IBM 3494 Tape Library can be reconfigured. This RPQ is required for moving feature numbers 5300, 5302, 5304, and 5400, or Models B16, D10, D12, D14, and S10, and will ensure that the proper cables are available. The RPQ will also prepare for future changes or enhancements.

B.8.3 The D12 Frame Must Always Be to the Left of the B16 Frame

If you are planning to use an already installed IBM 3494-D12 frame to hold the IBM 3590-B1A tape drives of the Virtual Tape Server, it has to be installed to the left of the IBM 3494-B16 frame (between the IBM 3494-B16 and the IBM 3494-Lxx frames). If you want to change an existing empty IBM 3494-D14 frame into an IBM 3494-D12 frame, you must submit an RPQ.

B.8.4 The D12 and B16 Frames Must Directly Attach to One Another

You cannot install another frame between the IBM 3494-D12 and the IBM 3494-B16 frames that include an IBM Magstar Virtual Tape Server.

B.8.5 A Modem Must Be Supplied for the IBM 3494-B16 Frame

It is mandatory that you supply a modem for installation, operation, and remote support service of the IBM 3494-B16 frame. The same modems as for the IBM 3591-A01 and 3590-A00 Remote Support Facility (RSF) are supported. You can obtain a list of these modems from your IBM representative.

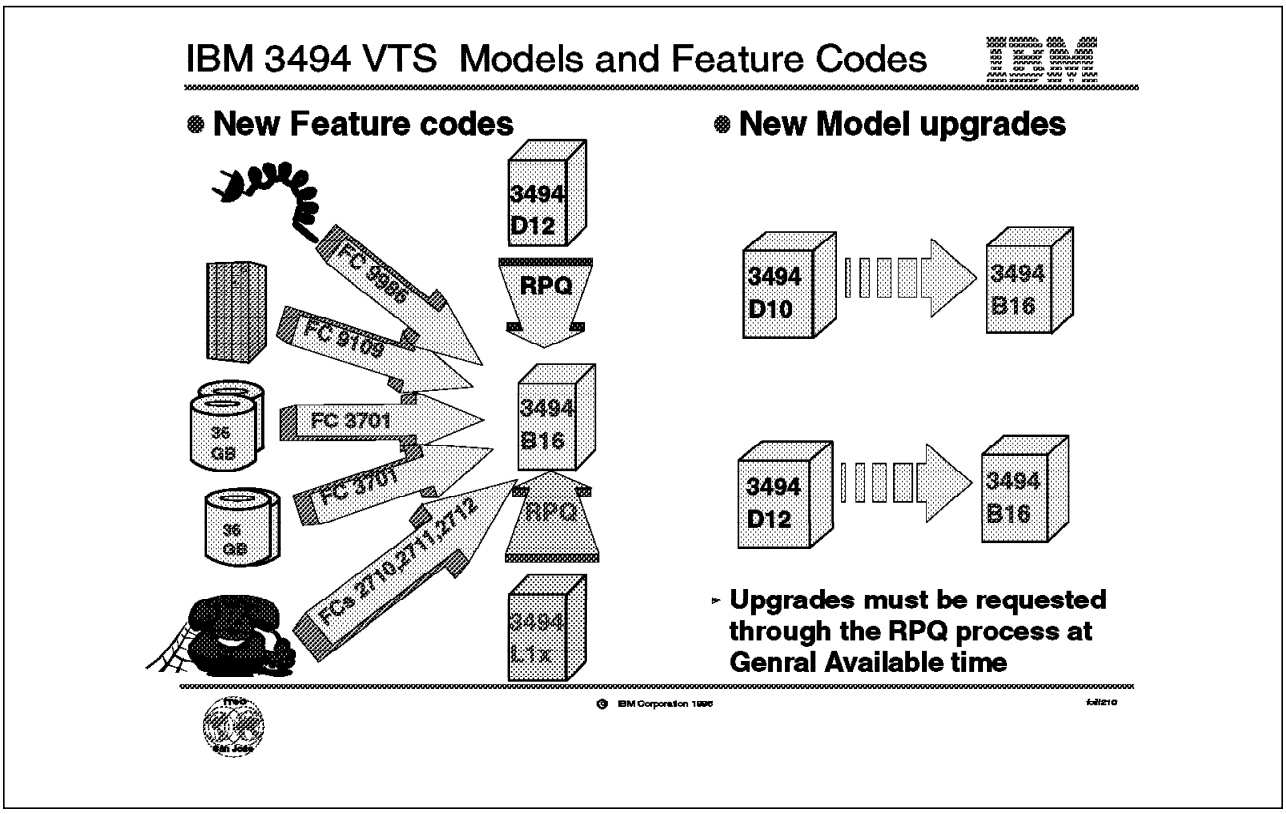

Figure 90. New IBM 3494 Features, Their Codes and Model Upgrades

B.9 New IBM 3494 Features, Their Codes and Model Upgrades

For integration of an IBM Magstar Virtual Tape Server into an existing IBM 3494, or for factory installation, you must order the features listed below. To use an existing IBM 3494 frames for installation of a Virtual Tape Server subsystem.

B.9.1 Features and Their Codes

To install an IBM 3494 plus IBM Magstar Virtual Tape Server, you must order some new features in addition to existing features and products. For instance, the IBM 3590-B1As that are installed inside the IBM 3494 Model D12 frame must be ordered separately.

B.9.1.1 IBM 3494 Model D12 plus Feature 9010

Feature 9010 for the IBM 3494 Model D12 frame indicates that the IBM 3590 tape drives in it are to be used by a Virtual Tape Server subsystem.

B.9.1.2 IBM 3494 Model L1x plus Feature 9006

To add an IBM 3494 Model B16 frame to a library, one feature 9006 must be specified for the library unit frames L10, L12, or L14 to track the number of frames installed in the library.

Note: Additional Library Manager connections are currently required for the installation of the Virtual Tape Server in an IBM 3494 tape library. Please refer to Section B.7, “IBM 3494 Host and Library Manager Attachment” on page 203 for details about feature codes 5228 and 5229.

B.9.1.3 IBM 3494 Model B16 Feature Codes

Feature 9109 must be specified for the IBM 3494 Model B16 frame to specify its connection to the S/390 host systems.

Feature 9986 is required to provide a special line cord for Chicago, Illinois, U.S.A.

Feature 3701 provides the DASD storage for the Tape Volume Cache. Each feature includes two DASD arrays providing you with 36 GB of usable Tape Volume Cache. Currently, you can order either one or two Features 3701:

- Order one Feature 3701 if three IBM 3590-B1As are installed in the Virtual Tape Server subsystem.
- Order two Features 3701 if six IBM 3590-B1As are installed in the Virtual Tape Server subsystem.

It is required that you supply a modem for installation, operation, and remote support service of the Model B16 frame and that you install one of the following features code. The same modem and switch may be shared between an IBM 3494 Model B16, and an IBM 3590 tape subsystem Model A00.

2710 Remote Support Facility

This feature supplies a cable and connectors to attach a customer-supplied modem to the IBM 3494 Model B16 for remote diagnostic support. This feature should be specified only on the first IBM 3494 Model B16, or IBM 3590 tape subsystem Model A00 in an installation, as the Model B16s and Model A00s can use the same Remote Support Facility. Each IBM 3494 Model B16 must specify either Feature 2710, 2711, or 2712.

2711 Remote Support Switch

This feature provides a switch, cables, and connectors for the attachment of a IBM 3494 Model B16, and one or more 3590 Model A00 Controllers to the Remote Support Facility (Feature Code 2710). It should be ordered on a IBM 3494 Model B16, IBM 3495 Model B16, or IBM 3590 tape subsystem Model A00 that is the second product in an installation. Only one switch should be specified per installation site. Each IBM 3494 Model B16 must specify Feature 2710, 2711, or 2712.

2712 Remote Support Attachment

This feature provides an additional cable and connector to attach to the Remote Support Switch (feature code 2711). Order it on the IBM 3494 Model B16, or IBM 3590 tape subsystem Model A00 — that is, the third through fourteenth product in the installation. Each 3494 Model B16 must specify Feature 2710, 2711, or 2712.

Features 2710, 2711 and 2712 are both plant and field installable.

B.9.2 Model Upgrades

You must apply for an RPQ if you wish to upgrade an existing IBM 3494 Model D10 or D12 frame to an IBM 3494 Model B16 frame. The following Model conversions may be supported:

- IBM 3494 Model L10 to L12
- IBM 3494 Model L10 to L14

- IBM 3494 Model D10 to D12
- IBM 3494 Model D10 to D14
- IBM 3494 Model D10 to B16
- IBM 3494 Model D12 to B16
- IBM 3494 features 5300 to 5302
- IBM 3494 features 5300 to 5304

If you want to upgrade one or two existing frames to a D12+B16 frame combination and the model upgrades are not listed, also please submit an RPQ.

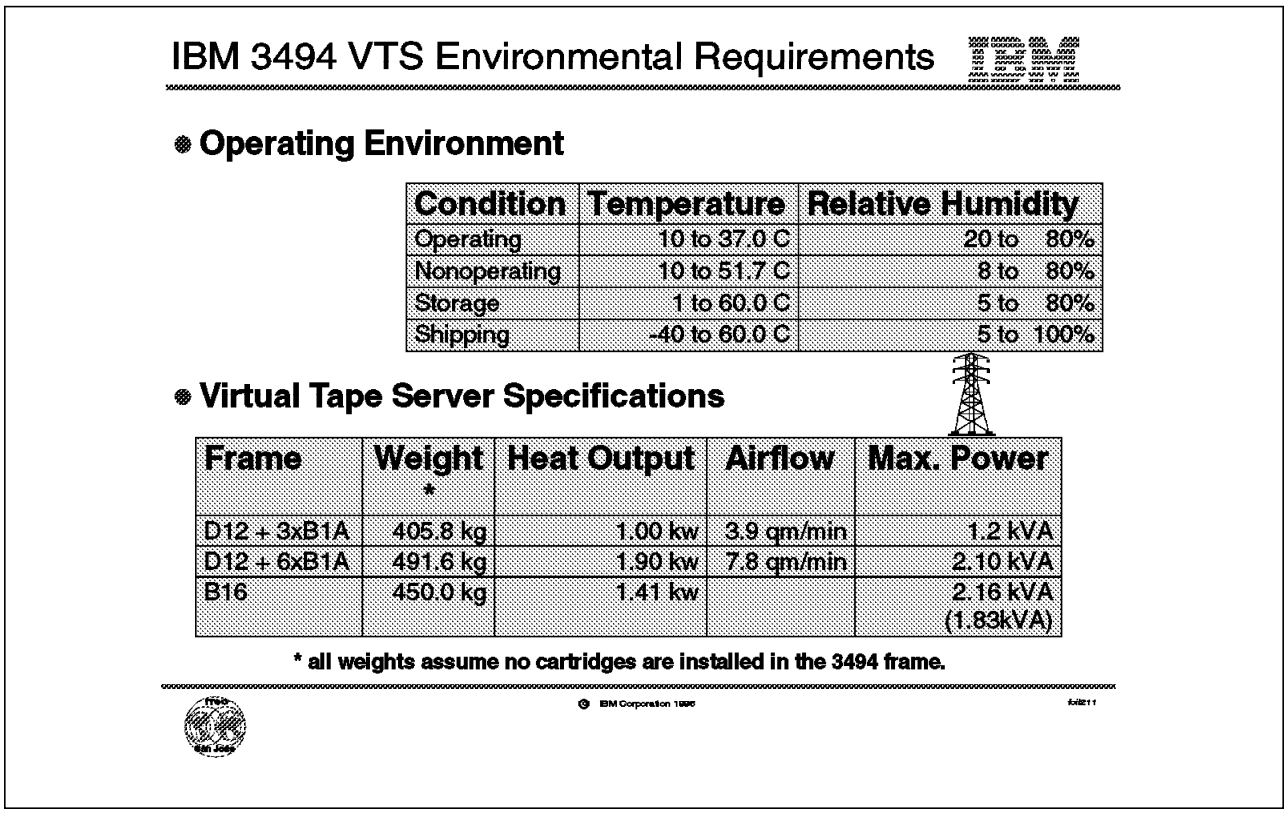

Figure 91. IBM 3494 Environmental Requirements

B.10 IBM 3494 Environmental Requirements

Figure 91 lists the physical specifications for the operation environment of an IBM 3494 tape library and the specifications for the Virtual Tape Server in IBM 3494.

The dimensions of the IBM 3494 Model B16 frame are the same as for every other IBM 3494 frame:

- Height: 1800 mm (70.9 in)
- Width : 750 mm (29.5 in)
- Depth : 1524 mm (60.0 in)

For further information on the Virtual Tape Server subsystem's physical installation please refer to *IBM 3494 Tape Library Dataserver Introduction and Planning Guide*.

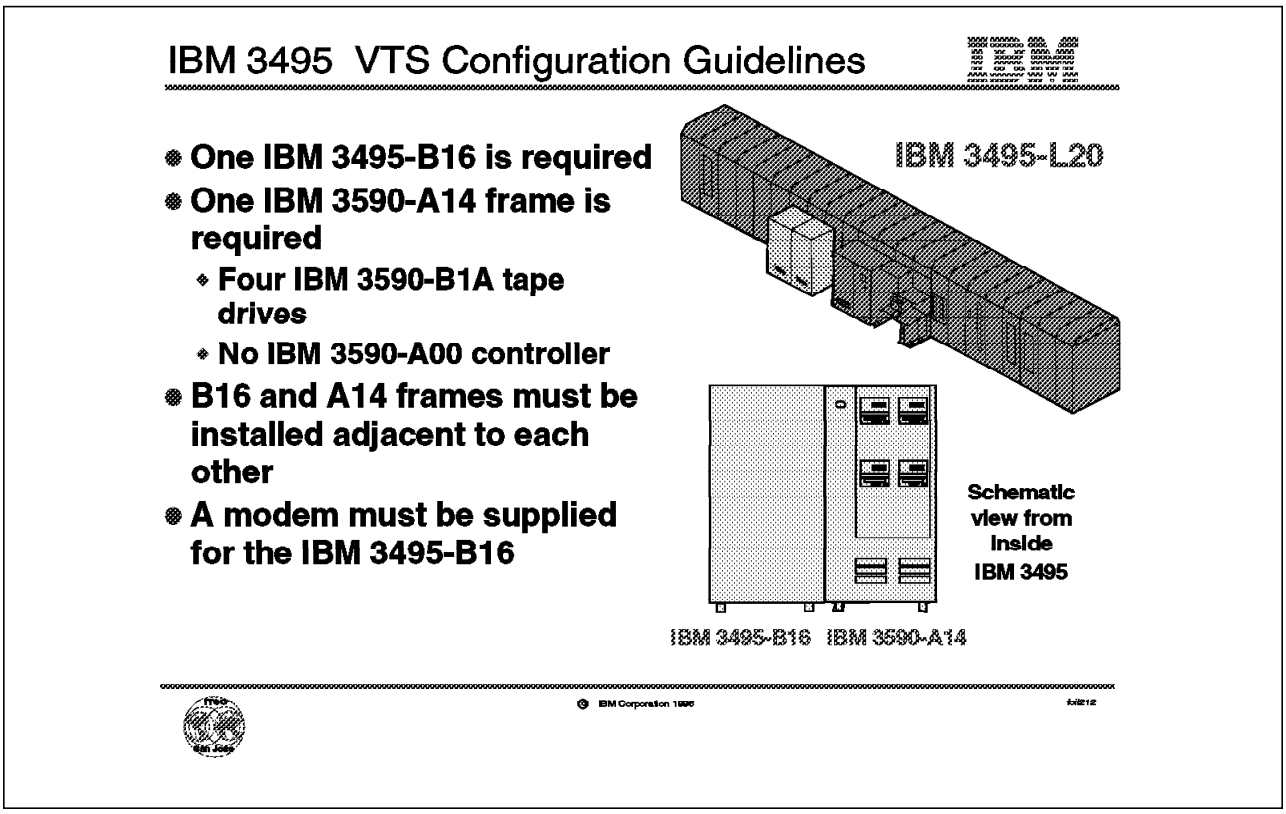

Figure 92. IBM 3495 Virtual Tape Server Configuration Guidelines

B.11 IBM 3495 Virtual Tape Server Configuration Guidelines

For physical configuration of an IBM 3495 Tape Library including the Virtual Tape Server, the following basic configuration rules apply:

B.11.1 One IBM 3495-B16 Must Be Installed

The IBM 3495-B16 provides the ESCON connection to the host, and houses the Tape Volume Cache and the Virtual Tape Server controller. In the IBM 3495 wall adjacent to the 3495-B16 storage cells can still exist, as is with the IBM 3490-Axx installed in an IBM 3495. These storage cells, which are managed by the Library Manager, can contain any cartridge and are not restricted to storing only Magstar cartridges that are used by Virtual Tape Server subsystem

B.11.2 One IBM 3590-A14 Frame Must Be Installed

One IBM 3590-A14 frame is required for the Virtual Tape Server subsystem. It contains four IBM 3590-B1As plus the necessary SCSI cabling to connect the tape drives to the IBM 3495-B16. Other than with ESCON-attached IBM 3590 tape drives the BM 3590-A14 frame used by a Virtual Tape Server does not require an IBM 3590-A00 control unit to be ordered.

You must order the IBM 3590-B1As in addition to the IBM 3590-A14 frame. However, you do not need to specify SCSI cables for the tape drives.

B.11.3 Library Manager Attachment

The Magstar tape drives residing in the IBM 3495-D12 frame are not attached to any host system. The drives are managed by the Virtual Tape Server controller. None of the IBM 3495 Library Manage RS-422 control unit ports are used by the VTS subsystem. They are attached solely to the Library Manager through a LAN connection to provide the required communication path for library-related commands, and to the Virtual Tape Server controller IBM 3495-B16.

The Virtual Tape Server controller is connected to the Library Manager through a dedicated LAN connection to provide the required communication paths.

B.11.4 IBM 3495-B16 and IBM 3590-A14 Must Be Installed Side by Side

The IBM 3495-B16 and the IBM 3590-A14 must be installed adjacent to one another. You cannot separate the two frames.

B.11.5 Reduction of IBM 3495 Storage Cells when a VTS is Installed

When a VTS is installed in an IBM 3495, the total amount of storage cells in the library may be decreased. If it is placed in a location where a 3490 subsystem already existed, the cell count is not affected. If the VTS is installed on an IBM 3495 Model L30, L40 or L50 in a position where no IBM 3490 string existed, then the cell count will drop by 520 tapes (two IBM 3495 storage racks, no reduction in the frame adjacent to the B16 frame).

B.11.6 A Modem Must Be Supplied for The IBM 3495-B16

It is mandatory that you supply a modem for installation, operation, and remote support service of the IBM 3495-B16. The same modems as for the IBM 3591-A01, and 3590-A00 Remote Support Facility (RSF) are supported. You can obtain a list of these modems from your IBM representative.

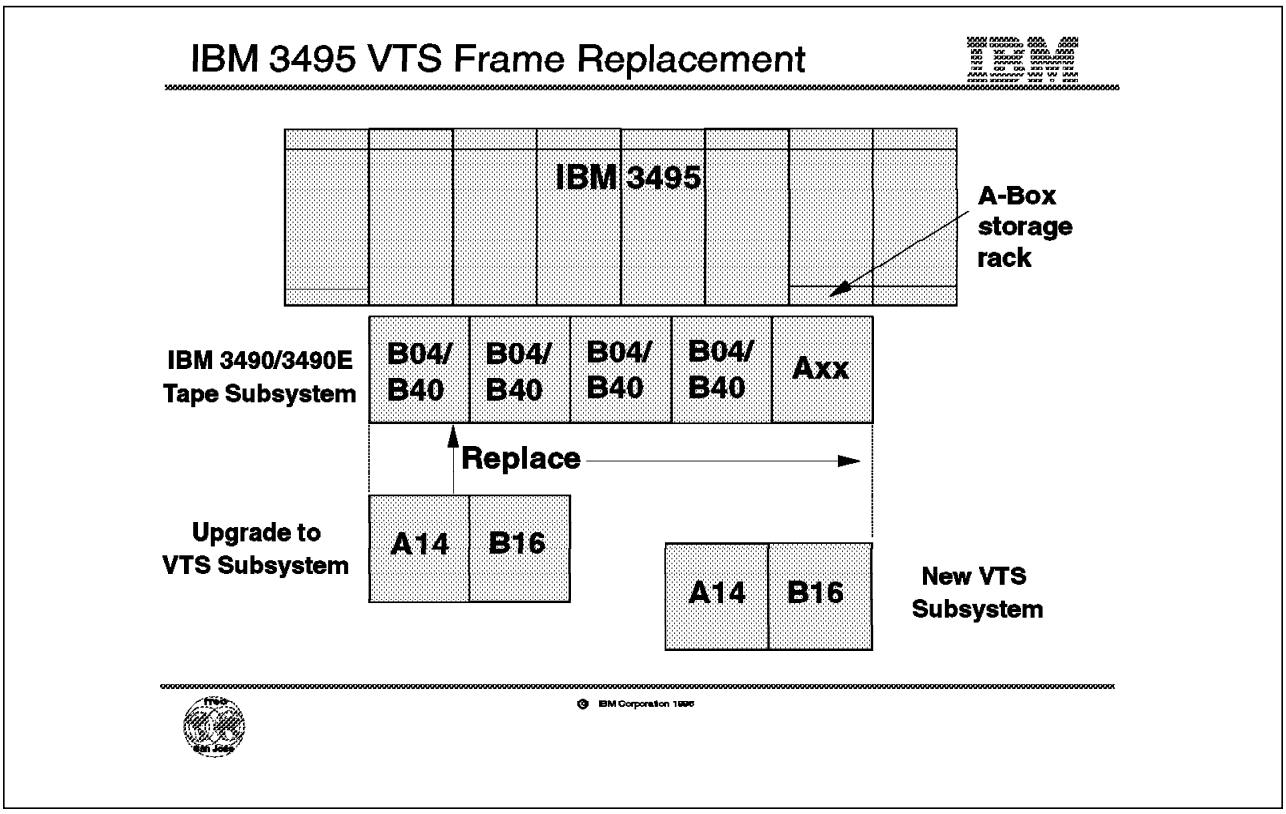

Figure 93. IBM 3495 Virtual Tape Server Frame Placement

B.12 IBM 3495 Virtual Tape Server Frame Placement

Each VTS subsystem is integrated into an IBM 3495 library through the installation of an IBM 3495-B16 and an adjacent IBM 3590-A14 frame. The IBM 3590-A14 frame must be installed to the left of the IBM 3495-B16 frame (when viewed from the front of the library) and must have no other frame between it and the IBM 3495-B16.

The two frames can be located along the library isle wherever IBM 3490 or 3590 tape subsystems can be installed. Figure 93 shows where the A14/B16 frames can be installed relative to where the IBM 3490 frames are installed. If the VTS is being installed and replaces part of an existing IBM 3490 subsystem, it is installed to the left of the remaining IBM 3490 frames. If the VTS is replacing the entire IBM 3490 tape subsystem or is being installed where there was no previous IBM 3490 tape subsystem, the rightmost edge of the IBM 3495-B16 frame is placed on the IBM 3495 frame boundary. This similar to IBM 3490-Axx frame placement rules.

If a VTS replaces an existing IBM 3490 tape subsystem, the existing “A” box cartridge rack is left in place, even though there is no front service access requirement for the IBM 3495-B16 frame. It is suggested that a filler cover be installed in the hole in this frame.

The maximum number of VTS subsystems per physical IBM 3495 library is four. At the initial GA of VTS on the IBM 3495, only one VTS is supported per IBM 3495.

The VTS subsystem controller uses the LAN attachment method to communicate with the Library Manager. This leaves all existing eight control-unit attachment ports (RS422) into the LM available to connect to IBM 3490 subsystems and IBM 3590-A00 attached IBM 3590 tape subsystems.

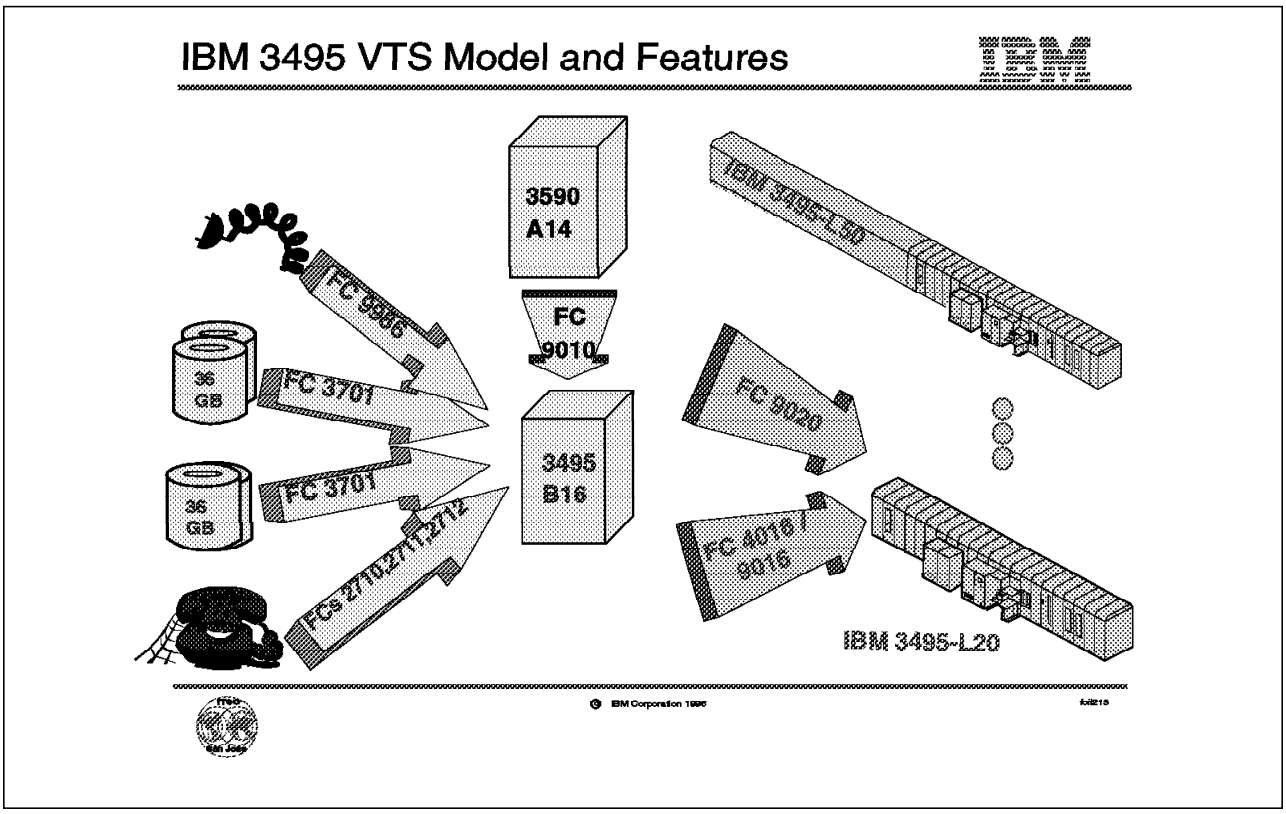

Figure 94. IBM 3495 Virtual Tape Server Models and Features

B.13 IBM 3495 Virtual Tape Server Models and Features

For integration of an IBM Magstar Virtual Tape Server into an existing IBM 3495, or for factory installation, you must order the features using the codes listed below.

To install an IBM 3495 plus IBM Magstar Virtual Tape Server, you must order the new features in addition to existing features and products. For instance, the IBM 3590-B1As that are installed inside the IBM 3590-A14 frame must be ordered separately. We list only the additional features that are required to include the Virtual Tape Server in the IBM 3495.

B.13.1 IBM 3590 tape subsystem Model A14 Plus Feature 9010

Feature 9010 for the IBM 3590-A14 frame indicates, that the IBM 3590 tape drives in it are to be used by a Virtual Tape Server subsystem.

B.13.2 IBM 3495 Model B16 Feature Codes

Feature 9986 is required to provide a special line cord for Chicago, Illinois, U.S.A.

Feature 3701 provides the DASD storage for the Tape Volume Cache. Each feature provides you with 36 GB of usable Tape Volume Cache. Currently, you can order either one or two Features 3701.

In addition to the modem you must supply for installation, operation, and remote support service of the IBM 3495-B16, you must install one of the following features:

2710 Remote Support Facility

2711 Remote Support Switch

2712 Remote Support Attachment

For detailed information on the features and their codes, please refer to Section B.9, “New IBM 3494 Features, Their Codes and Model Upgrades” on page 207.

B.13.3 Feature Codes For IBM 3495 Model L20, L30, L40 and L50

When a Virtual Tape Server is installed in an IBM 3495, Feature 9020 must be specified for the tape library. This feature provides the hardware and microcode for the Library Manager to VTS controller communication path.

For a plant-installed IBM 3495-B16, you must order Feature 9016; for field installation, order Feature 4016.

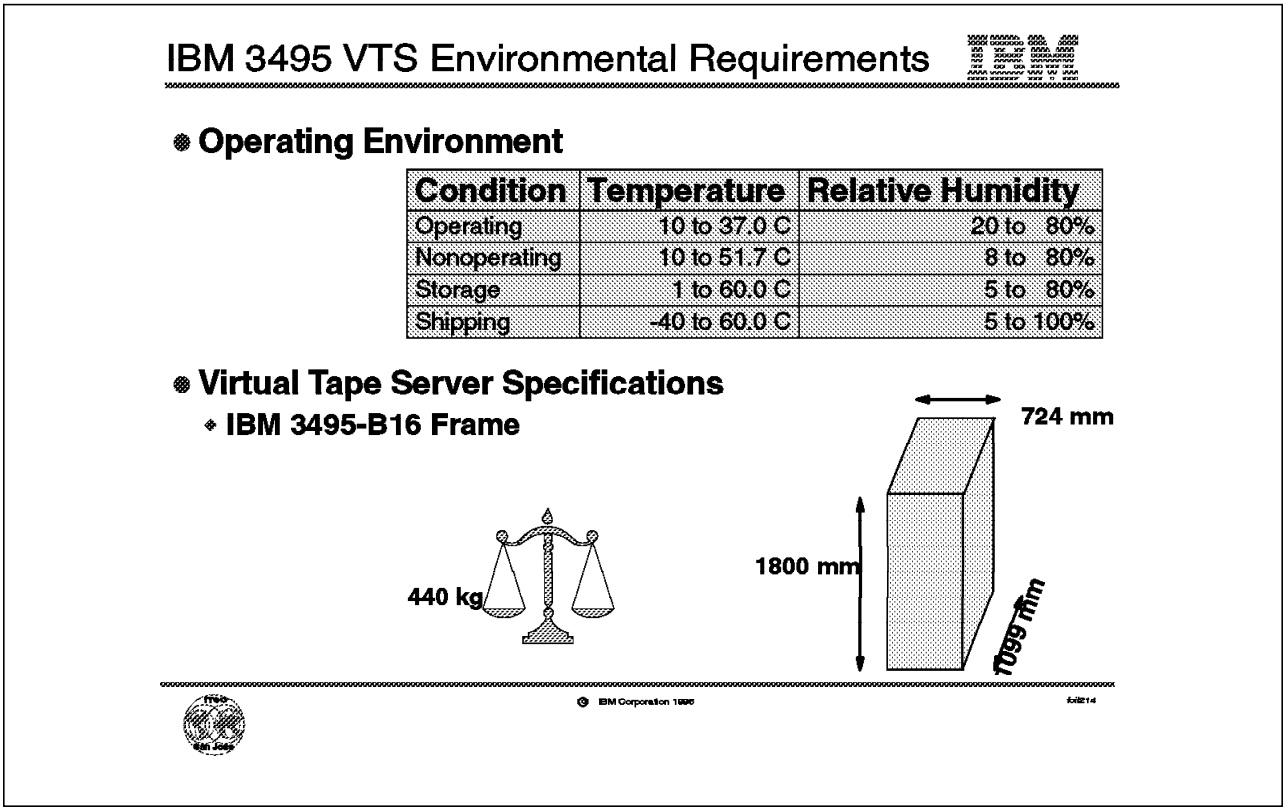

Figure 95. IBM 3495 Environmental Requirements

B.14 IBM 3495 Environmental Requirements

Figure 95 lists the physical specifications for the operation environment of an IBM 3495 tape library and the specifications for the Virtual Tape Server in the IBM 3495.

For further information on the Virtual Tape Server subsystem's physical installation please refer to *IBM 3495 Tape Library Dataserver Introduction and Planning Guide*.

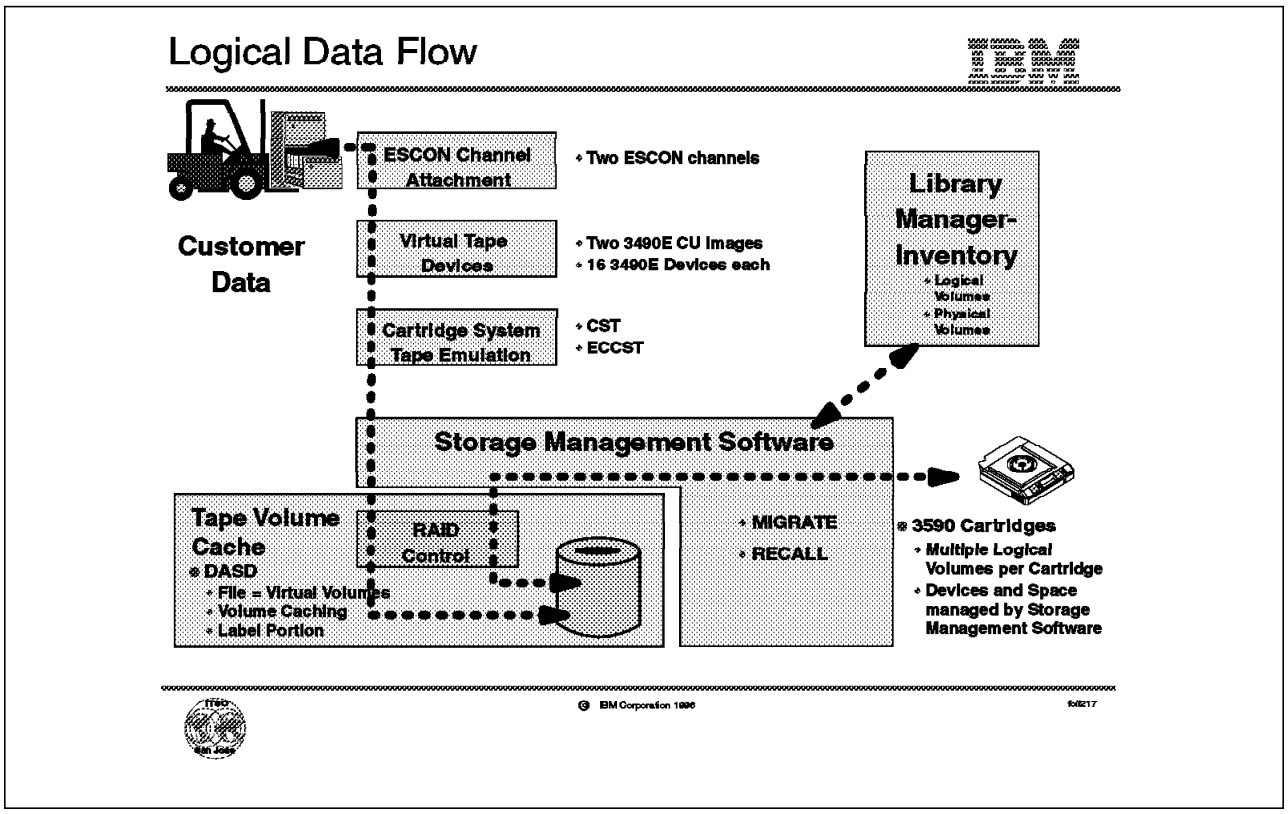

Figure 96. Logical Data Flow

B.15 Logical Data Flow

Figure 96 shows the logical data flow though an IBM Magstar Virtual Tape Server subsystem.

The host system has knowledge about the following components and interfaces that allow it to write data onto tape:

ESCON channel attachment: The host knows that there are two ESCON channels to the (virtual) 3490E tape drives. Either ESCON channel can access all virtual tape drives.

Virtual tape devices: The host sees two IBM 3490E control unit images, each of them fully configured with 16 tape drives for a total of 32 virtual 3490E tape drives.

Cartridge system tape emulation: The host can use virtual CST or ECCST media to store its data.

Library Manager: Through the Library Manager, the host is informed about logical volumes available in the IBM 3494 or 3495 tape library, their status, and status changes as well as about the status of the virtual devices.

The physical storage and management of the data written by the host is invisible to the host and its applications.

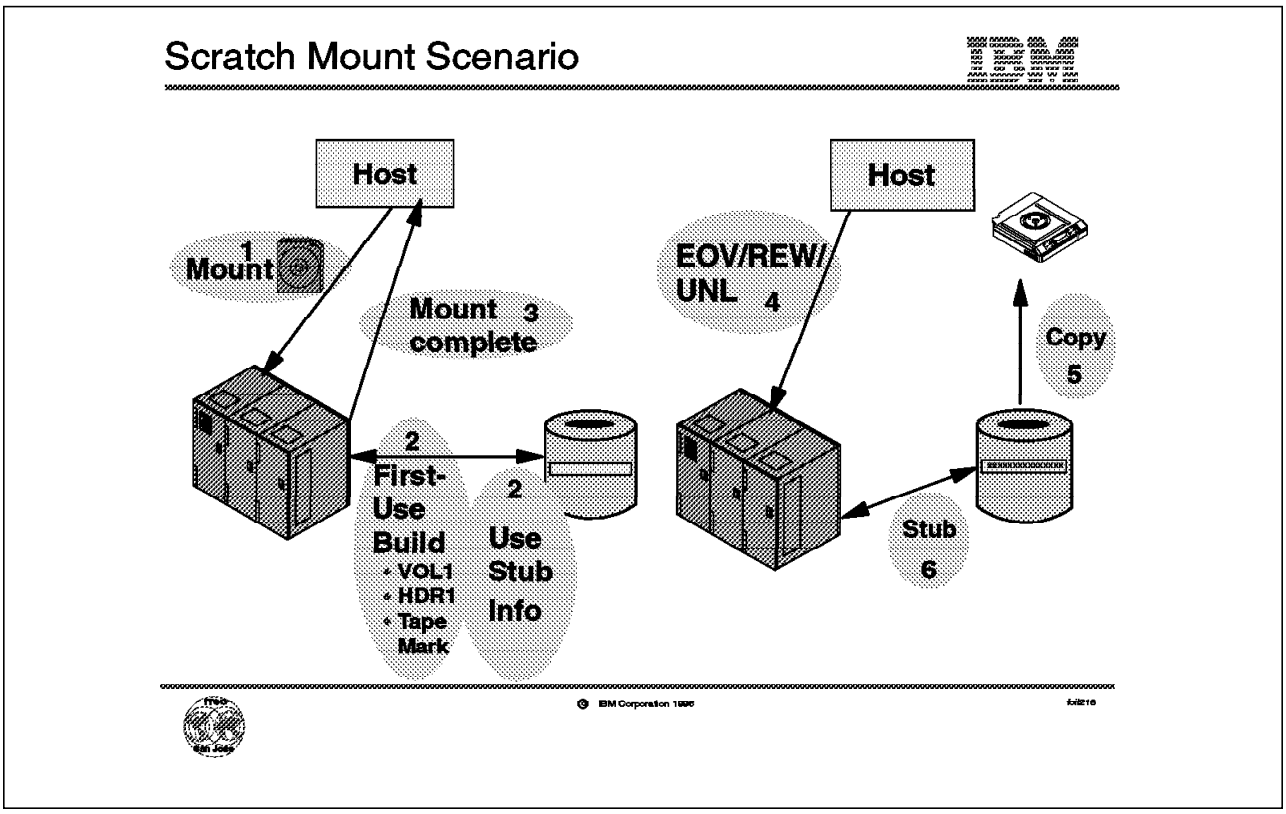

Figure 97. Scratch Mount Scenario

B.16 Scratch Mount Scenario

The Virtual Tape Server has special facilities for handling scratch (nonspecific) type mount. With the following facilities, the Virtual Tape Server processes scratch-mount requests in a fast and efficient manner.

- Virtual Volume Use Information.

  After the first usage of a volume serial number as a virtual volume, information about that usage is maintained in the Tape Volume Cache even though most of the volume's data has been moved onto a Magstar cartridge into a logical volume. This portion of the data from the last usage of the volume is called the stub and includes the first several hundred bytes of data written during the last use of the volume. The information includes at least the data records that include a tape label.

- Automatic Initialization of a virtual volume on its first use.

  Prior to the first use of a volume serial number as a virtual volume, the Tape Volume Cache will not have any information about the previous use of the volume. When the volume is mounted for the first time, the Storage Management Software will generate a set of records for the volume in the Tape Volume Cache as if the volume had been initialized using EDGINERS or IEHINITT specifying an IBM standard label, that is the volume will contain a VOL1, HDR1 and Tape Mark.

- Outboard Management of Volume Pools (Categories).

  The IBM Tape Libraries, along with host software, provide a facility to have the Library Manager manage groups of volumes in pools. The pools are

called Categories and the host can assign one or more volumes to a category and later ask for a mount of a volume from the category. The Library Manager, on receiving a mount from category request, will select a volume from the specified category and make it ready on a tape device. As part of the operation to make the volume ready on a tape device, the Library Manager passes the volume serial number of the volume mounted back to the host software. Through the use of categories, the Library Manager can maintain a set of volumes that can be used for scratch mounts. Depending on the host software support at least two categories are used for scratch mounts, one for Media Type 1 - Standard Cartridge System Tape and one for Media Type 2 - Enhanced Capacity Cartridge System Tape.

- Fast-Ready Attribute for Categories

  With the introduction of the Virtual Tape Server, an attribute can be assigned to a category that allows the Storage Management Software in the Virtual Tape Server to know that it can use the last usage information maintained in the Tape Volume Cache to process a nonspecific mount instead of having to recall the complete logical volume for the selected volume from a Magstar cartridge. The attribute for a specific category is set by the operator through a panel on the Library manager.

- Logical Volume Data Invalidation

  Like a physical volume, the data that resides in a logical volume is accessible until two things happen. First, the Tape Management System determines that the data on the volume has expired and returns the volume to a scratch pool. Second, the volume is mounted in response to a scratch mount request and new data is written on the volume from the beginning of tape. The Storage Management Software in the Virtual Tape Server maintains a database to where the current accessible version of a logical volume is located on the IBM 3590 tape cartridges that it manages. This is done independent of whether the Tape Management System has returned the volume to a scratch pool or not. It is only when the volume serial number of the logical volume is reused as a virtual volume and modified, either from the beginning of tape or in an append operation, that the old location of the logical volume is deleted and the space it represents marked as invalid. When the new version of the logical volume is migrated to a Magstar cartridge, it will be in a different location on a different cartridge.

A nonspecific mount request for the first time a volume serial number is used is processed with the following steps:

1. The host sends a mount request for a scratch cartridge by specifying the category that contains either CST or ECCST volumes. The categories have the Fast-Ready attribute set. The Library Manager selects a logical volume serial number to satisfy the mount request.
2. The Storage Management Software in the Virtual Tape Server checks whether the selected volume has prior usage information in the Tape Volume Cache. Since this is the first usage of the volume, there will not be any information. The Storage Management Software will create that information including the data records for a VOL1, HDR1 and tape mark.
3. Mount complete is signaled to the host which then can write data to the virtual volume. Since there was no physical mount of a volume required, the nonspecific mount request is handled much faster than in a conventional tape library.

4. When the host closes the volume, End-of-Volume (EOV) processing is performed, and the volume is rewound and unloaded.
5. After the volume is unloaded, the virtual volume is scheduled to be copied onto a physical IBM 3590 cartridge.
6. After it is copied, the virtual volume remains in the Tape Volume Cache until the space it occupies is needed for other virtual volumes. When a virtual volume′s space is needed, most of the volume′s data is deleted, leaving a small portion stub of the volume′s data. That stub has enough space to include the VOL1, HDR1 and HDR2 records, URL1 through URL8 records if present and a tape mark. Selection of when a virtual volume is stubbed in the Tape Volume Cache is through a Least Recently Used (LRU) algorithm.

After the host has expired the data on the logical volume, it becomes a scratch volume again and can be selected by the Library Manager in response to a mount request for a scratch volume.

A nonspecific mount request for a subsequent use of a volume serial number is processed with the following steps:

1. The host sends a mount request for a scratch cartridge by specifying the category that contains either CST or ECCST volumes. The categories have the Fast-Ready attribute set. The Library Manager selects a logical volume serial number to satisfy the mount request.
2. The Storage Management Software in the Virtual Tape Server will find that the selected volume has prior usage information in the Tape Volume Cache. This information contains all of the data records that the host Tape Management Software needs to validate the usage of the volume for a nonspecific mount request.
3. Since the volume was selected from a category that had the Fast-Ready attribute set, the Storage Management Software signals the host that the mount is complete without having to recall all of the data from the last usage of the volume from a physical cartridge. This results in a very low mount-response time since no physical movement or mounting of a cartridge is involved.
4. Same as in the first usage of a volume serial number.
5. After the volume is unloaded, the virtual volume is scheduled to be copied onto a physical 3590 tape cartridge. It is at this point that the last version of the data associated with the volume serial number is invalidated.
6. Same as in the first usage of a volume serial number.

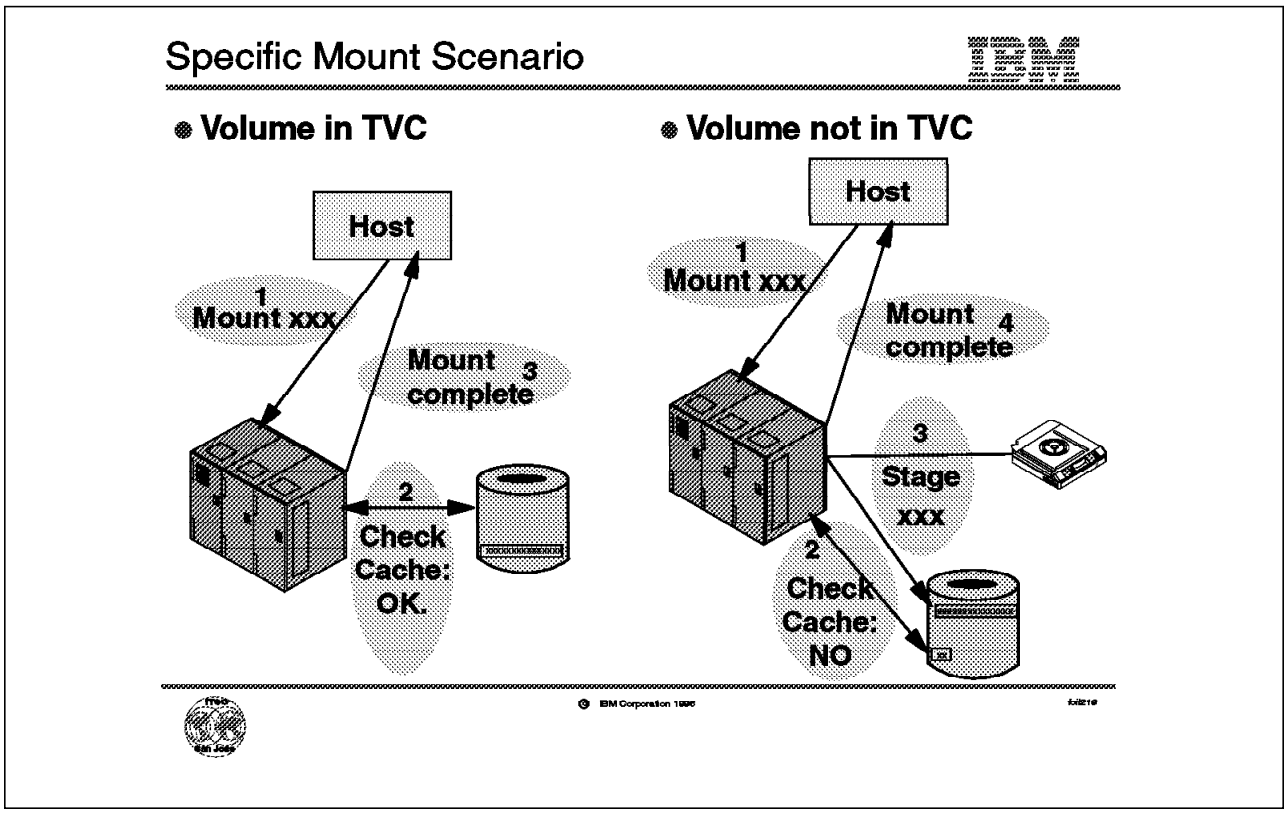

Figure 98. Specific Mount Scenario

B.17 Specific Mount Scenario

When the host requests a specific logical volume, and the virtual volume exists in the Tape Volume Cache, no physical mount is required to access this volume. If the Tape Volume Cache contains only the usage information stub, the logical volume has to be staged to the Tape Volume Cache first and become a virtual volume before the host can process it.

B.17.1 Volume in Tape Volume Cache

In case the virtual volume resides in the Tape Volume Cache, the host can process the volume almost immediately, allowing very fast mount-response times.

B.17.2 Volume not in Tape Volume Cache

If the logical volume resides only on tape, it must be staged to the Tape Volume Cache first. This involves a physical mount, positioning the tape and copying the logical volume to the Tape Volume Cache. Mount complete is signaled to the host system only after the complete volume is available in the Tape Volume Cache.

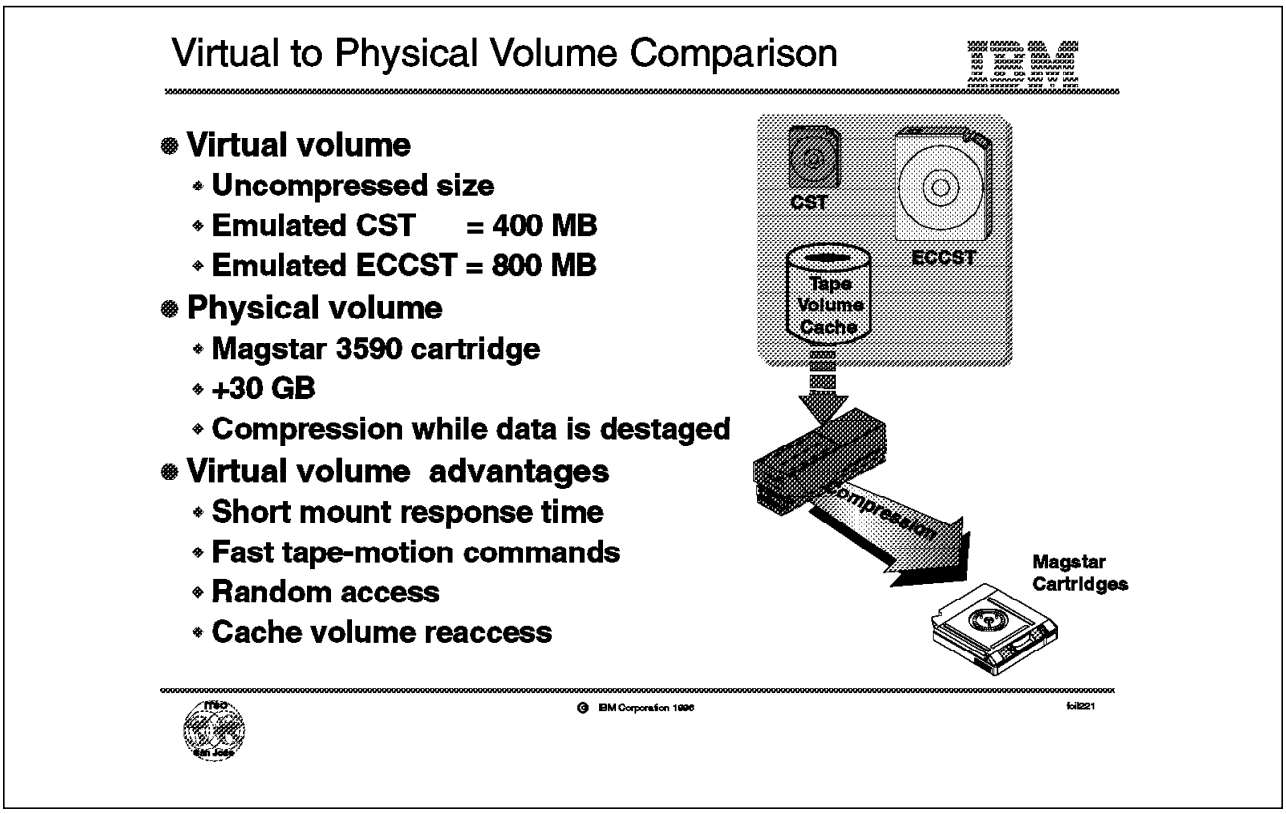

Figure 99. Comparison of Virtual to Real Volumes

B.18 Virtual to Real Volume Comparisons

In this section we compare the virtual volumes to real or physical volumes and list the advantages of the Virtual Tape Server implementation through 3490E emulation.

B.18.1 Virtual Volume

When the host application selects a tape, it can define whether it wants a media type of MEDIA1 or MEDIA2 to be used by using an appropriate data class. For example, if a volume residing in a Virtual Tape Server subsystem is selected, a virtual volume is created. A virtual volume is an emulated CST cartridge when MEDIA1 is selected, or ECCST when MEDIA2 is selected.

B.18.1.1 Uncompressed Size

The Virtual Tape Server controller does not have the hardware compression feature that allows a real 3490 device to store more data than the amount specified below on a single logical volume.

This might result in more multivolume files when migrating from real to emulated 3490E cartridges.

B.18.1.2 CST = 400 MB

The emulated CST cartridge stores up to 400 MB. This is different from a real CST cartridge, which can hold more than 400 MB because of the effects of IDRC. Assuming an average IDRC ratio of 1:3, a real CST cartridge can hold up to 1.2 GB of data.

Applications that attempt to directly copy a real CST cartridge onto an emulated CST cartridge will fail if more than 400 MB are on the real cartridge and the application cannot handle the change to a multivolume file. DFSMShsm is an example of such an application. A copy of an emulated CST cartridge to a real cartridge, however, will always fit.

B.18.1.3 ECCST = 800 MB

The emulated ECCST cartridge stores up to 800 MB. This is different from a real ECCST cartridge, which can hold more than 800 MB because of the effects of IDRC. Assuming an average IDRC ratio of 1:3, a real ECCST cartridge can hold up to 2.4 GB of data.

Applications that attempt to directly copy a real CST cartridge onto an emulated CST cartridge will fail if more than 400 MB are on the real cartridge. A copy of an emulated CST cartridge to a real cartridge, however, will always fit.

B.18.2 Physical Volume

The physical volumes used in a Virtual Tape Server subsystem to store logical volumes are 3590 cartridges which provide a capacity of 10 GB if the data is not compressed. Because of a compression algorithm that is improved over the IDRC function of IBM 3490E devices, an IBM 3590 cartridge can store over 30 GB data.

The compression takes place in the IBM 3590 tape drive at the time the data is copied from the Tape Volume Cache to 3590 cartridges.

Assuming a compression ratio of 3:1, a single 3590 cartridge can physically store up to 75 emulated CST cartridges or up to 37 emulated ECCST cartridges, although the application cannot handle the change to a multivolume file. DFSMShsm is an example of such an application.

B.18.3 Virtual Volume Advantages

A virtual volume is physically stored on DASD and therefore has some advantages over traditional tape processing.

B.18.3.1 Mount response time

The mount response time for a scratch mount request is a fraction of the time required on a physical volume because it is not dependent on the physical movement of a cartridge or the loading and threading delays of a physical tape.

The mount response time for a specific mount request, where the volume is in the Tape Volume Cache, is a fraction of the time required on a physical volume because of the same reasons as above.

B.18.3.2 Fast tape motion commands

Tape positioning command such as Locate, Space or Rewind, for example, are performed in a fraction of the time required for a physical volume.

A Rewind/Unload command is performed in a fraction of time because it is not dependent on the delays of tape movement on a physical tape device.

B.18.3.3 Random access

You can randomly access tape data through the use of the available tape commands Read Block ID and Locate Block ID

B.18.3.4 Cache Volume reaccess

In many cases, data that is written to a tape volume from one job or job step is read by a subsequent job or job step. The time between creation and reaccess is variable. However, very often the reaccess occurs within the next few hours.

The Tape Volume Cache is large enough to hold virtual volumes for several hours after they have been copied to stacked 3590 cartridges. The duration of this period is dependent upon the Tape Volume Cache size and amount of data written by the host per hour.

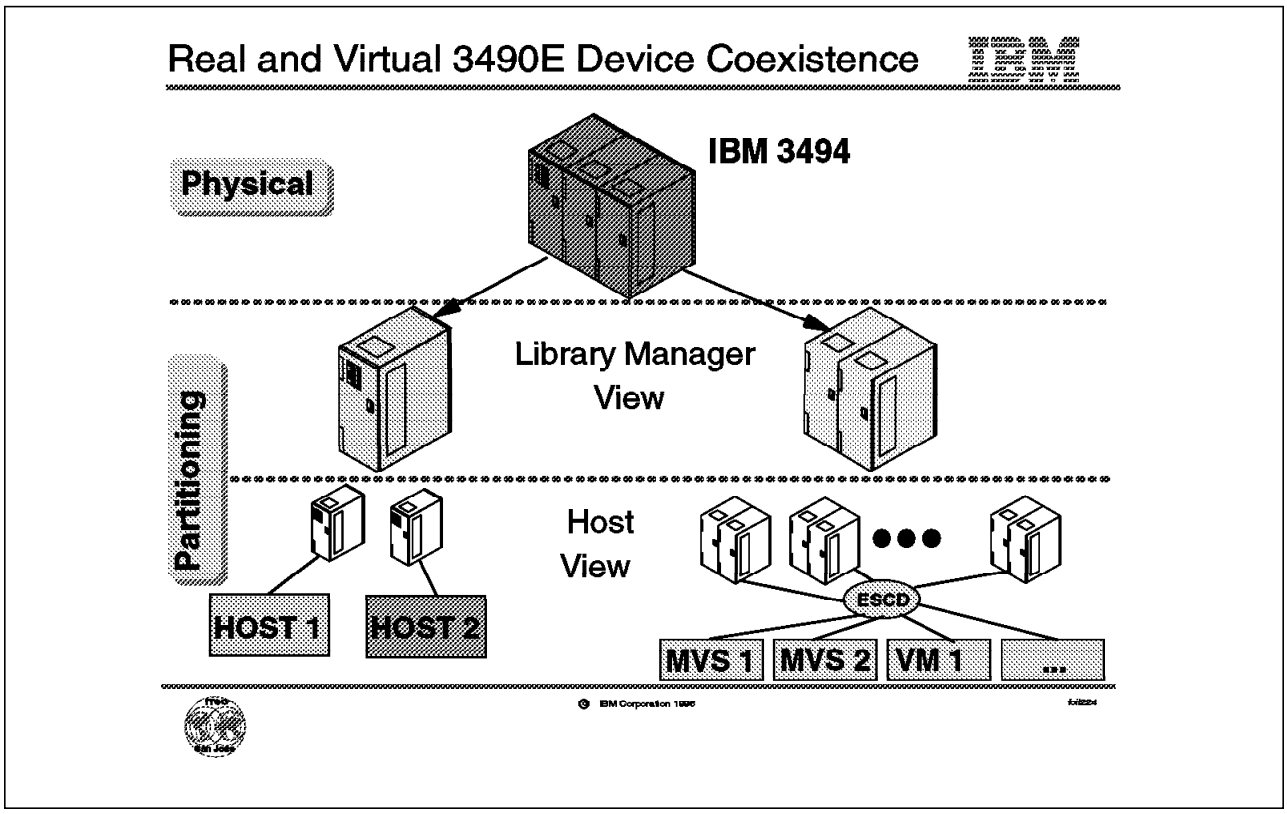

Figure 100. Real and Virtual 3490E Device Coexistence

B.19 Real and Virtual 3490E Device Coexistence

To support the coexistence of both real and virtual 3490E type devices in the same physical library, the library is logically partitioned.

Figure 100 shows the physical and logical implementation of an IBM Magstar Virtual Tape Server.

B.19.1 Physical Installation

A Virtual Tape Server subsystem must be installed in an IBM 3494 or 3495 tape library because the physical assets used by the Virtual Tape Server subsystem are managed by the Library Manager in the library. The physical assets include the Magstar tape drives and the Magstar cartridges used for stacking logical volumes.

B.19.2 Library Manager View

The Library Manager provides the support for logical partitioning of an IBM 3494 or 3495 tape library. To support the Virtual Tape Server's capability to coexist with current native IBM 3490, 3490E, and 3590 tape devices in the same library, the Library Manager partitions the physical library into logical libraries. This must be done because the Virtual Tape Server presents an image of 3490E tape devices, and yet cannot read or write a real CST or ECCST type cartridge. By placing a Virtual Tape Server subsystem in its own logical library, the possibility of host software allocating a virtual 3490E tape device for a real 3490 mount is removed. This also removes the possibility that host software could allocate a real 3490 mount instead of a virtual 3490E tape device.

A logical library can contain either a Virtual Tape Server subsystem, or current IBM 3490/3490E with or without native IBM 3590 tape subsystems. Given general availability of the IBM Magstar Virtual Tape Server, each physical IBM 3494 or 3495 tape library can be partitioned into two logical libraries:

- One contains one Virtual Tape Server subsystem
- The other contains all real IBM 3490 and all native IBM 3590 subsystems.

B.19.3 Host View

Each logical library has its own library sequence number used in defining the logical library to the host and therefore looks like a separate physical library to the hosts attached to that partition.

A single logical Virtual Tape Server library, can be shared by multiple MVS, VM, and VSE guest systems in the same way that a physical library can be shared.

For details on sharing or partitioning a logical library, please refer to the *Guide to Sharing and Partitioning IBM Tape Library Dataserver*.

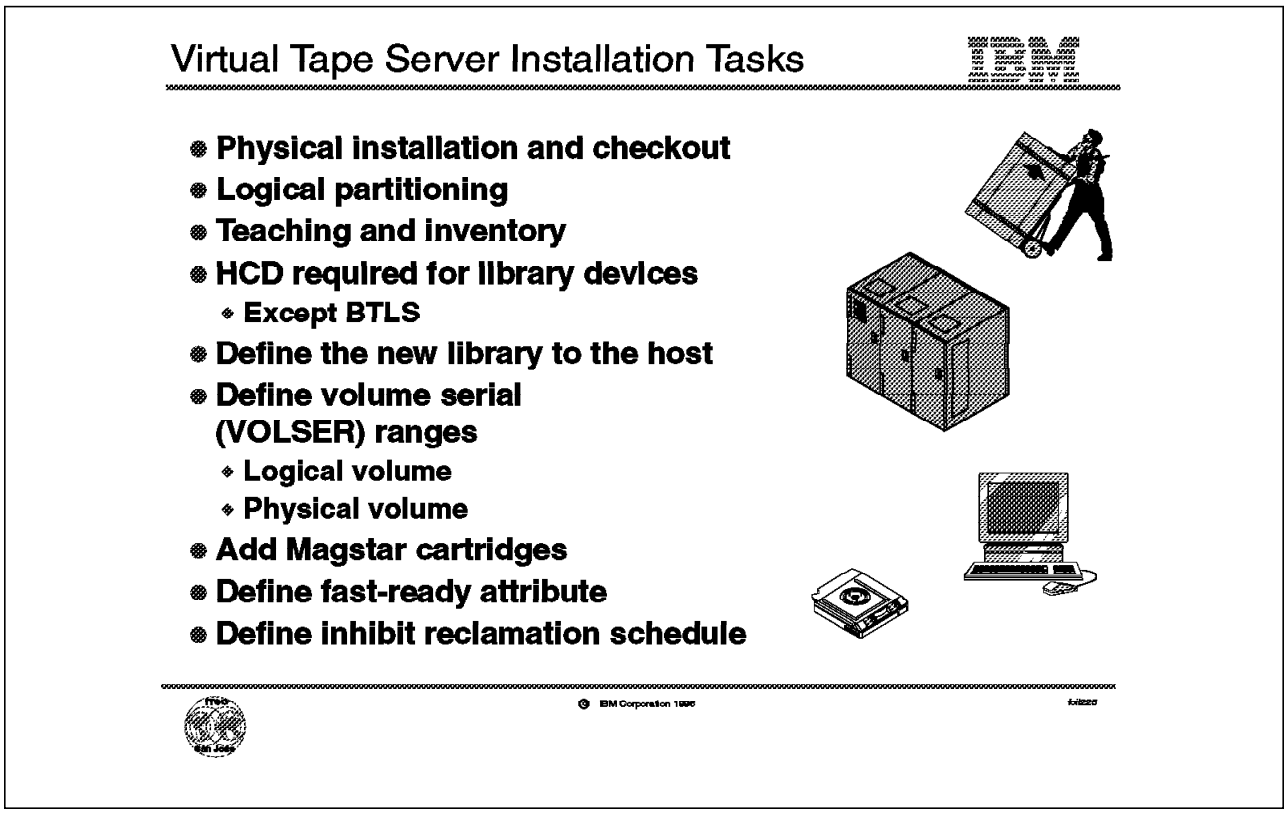

Figure 101. Virtual Tape Server Installation Tasks

B.20 Virtual Tape Server Installation Tasks

Figure 101 describes the tasks involved in installing an IBM Magstar Virtual Tape Server.

B.20.1 Physical Installation and Checkout

Hardware installation and checkout involves installing the hardware components of the Virtual Tape Server and performing the subsystem setup. At times during this phase, the library will either be unavailable to the host or degraded, because manual mode operation is required to satisfy host requests.

B.20.2 Logical Partitioning

Logical partitioning is performed by the hardware customer engineer as part of the physical installation of the Virtual Tape Server subsystem.

B.20.3 Teach and Inventory

Teaching the robotics the locations of the Magstar tape drives associated with the Virtual Tape Server and inventory of storage cells in the Virtual Tape Server frames is performed by the hardware customer engineer (CE) or customer service representative (CSR) as part of the Virtual Tape Server subsystem installation.

B.20.4 Hardware Configuration Definition (HCD) Required For Library Devices

Because the virtual tape drives of the Virtual Tape Server are library resident, you must define them through the hardware configuration definition dialogue specifying LIBRARY=YES. As for the VTS drives resident in the physical library, there is no definition in IOCP/MVSCP/HCPRIO.

For BTLS-managed libraries, HCD is not required, because BTLS does not require the LIBRARY=YES definition.

B.20.5 Define the New Library to the Host

For details on defining a new library to the host, please refer to Figure 102 on page 231.

B.20.6 Define Volume Serial Number Ranges

Although a physical library partitioned in the way described in Figure 100 on page 226 looks like two separate libraries to the host, they share the same library manager and its database. Because of this, the volume serial numbers of both the virtual and physical volumes in the same physical library must be unique.

Before you can insert physical 3590 cartridges for use by the Virtual Tape Server subsystem into a library, you must define them through the Library Manager console. You must also define a beginning set of volume serial ranges for your virtual volumes as well.

Volume serial numbers supported by the Virtual Tape Server must be six characters long and contain either an alphabetic or numeric character in any character position.

You add the volume serial number ranges through a Library Manager panel that contains two edit fields. If just one volume serial number is to be added, you enter the volume serial number in the first field and leave the second field empty. If a range of volume serial numbers is to be added, enter the two volume serial numbers that indicate the ends of the range in the two fields. You do not need to be concerned with which end to put in which field; the Library Manager will determine the range expansion regardless of whether the highest volume serial number is in field one or two.

Both volume serial numbers must have the same format. The same format means that if a character position in the first volume serial number is alphabetic, the corresponding character position in the second must be alphabetic as well. Likewise, if a character position in the first is numeric, the corresponding character position in the second one must also be numeric. For example, a range of ABC000 through ABD999 is valid, but ABC000 through ABCD99 is invalid.

To add multiple ranges, simply repeat the volume serial number entry process.

Volumes defined through the Library Manager console are processed as described below:

Logical

The Library Manager expands the specified volume serial number range, adds the resultant volumes to its inventory, places them in the

insert category and notifies all attached hosts. The hosts can then perform insert processing for these volumes as they would for physical cartridges in the library.

The range of volumes is expanded starting with the lower valued volume serial number (A is less than B, B is less than C, and so on). The volume serial number is incremented where alphabetic characters are incremented alphabetically and numeric characters are incremented numerically. For example, a volume serial number range specified as ABC000 and ABD999 would result in 2000 volumes being added (ABC000 - ABC999 and ABD000 - ABD999).

Physical If a 3590 cartridge is inserted into a library and fits into the volser range defined for physical volumes used by the Virtual Tape Server subsystem, the Library Manager does not notify any host. Management of these cartridges is under control of the Library Manager and the Virtual Tape Server subsystem. If you did not define the physical volumes for use by the Virtual Tape Server subsystem before entering them into the library, the Virtual Tape Server subsystem will not be able to use these cartridges.

You do not have to define all of the logical and physical ranges during installation. As needed, additional volume serial number ranges may be added later. You also do not have to have add all of the physical 3590 cartridges you defined at one time, they can be added as needed.

B.20.7 Add Magstar Cartridges

After you have defined the Magstar cartridges through the Library Manager console, you can insert them into the IBM 3494 or 3495 tape library.

B.20.8 Define Fast-Ready Categories

To take advantage of the scratch-mount performance advantages of the Virtual Tape Server, as described in Section B.16, “Scratch Mount Scenario” on page 219, you need to indicate to the Library Manager the numbers of the categories used by the host for scratch volumes. You do this through the Library Manage console. The Library Manager provides a panel by which a 4-digit category number can entered. This will add the category to the list of categories in the library that have the Fast-Ready attribute set. To reset a category′s Fast-Ready attribute, the Library Manager panel allows you to highlight one of the categories in the list with the Fast-Ready attribute set and then request that it be reset.

B.20.9 Define Reclamation Schedule

To minimize the effect of IBM Magstar Virtual Tape Server internal space reclamation on your tape operation, you can inhibit space reclamation for certain periods of time through the Library Manager console.

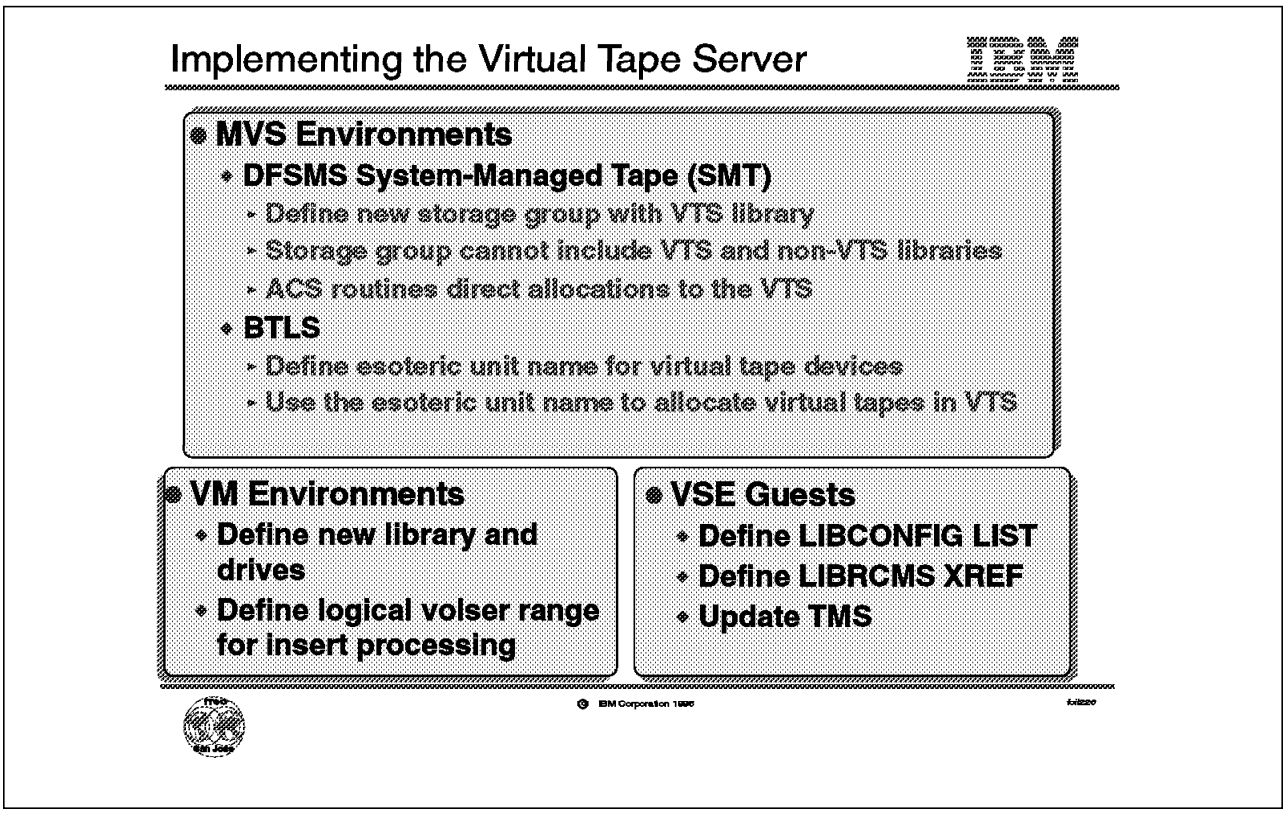

Figure 102. Implementing the Virtual Tape Server

B.21 Implementing the Virtual Tape Server

From software point of view, the Virtual Tape Server is same as the IBM Automated Tape Library Dataserver with IBM 3490E tape drives. We explain how to implement the Virtual Tape server in MVS/ESA, VM/ESA, and VSE/ESA environments.

B.21.1 MVS/ESA Environments

In general, the Virtual Tape Server subsystem must be defined as a new tape library, with IBM 3490E tape drives as the host system.

B.21.1.1 DFSMS System-Managed Tape (SMT)

To use the Virtual Tape Server subsystem under SMT, you must define the virtual 3490E devices through HCD specifying LIBRARY=YES.

During hardware installation of the Virtual Tape Server, the customer engineer assigns a five-character library sequence number to the VTS library. You use this sequence number to define a new library to SMS through the ISMF Library application.

To direct allocations to the Virtual Tape Server subsystem, you must define new storage groups that only contain VTS libraries. You cannot intermix VTS and non-VTS libraries in the same storage group. However, if you have more than one VTS library installed, you can define storage groups that span more than one VTS library.

You must change your ACS routines to assign these newly defined storage groups. If the storage group ACS routine assigns a storage group that contains a VTS library, the tape data set is directed to the Virtual Tape Server subsystem.

For details on the implementation in an SMS managed environment, please refer to the *DFSMS/MVS Version 1 Release 3 Object Access Method Planning, Installation, and Administration Guide for Tape Libraries*. For further information on sharing a VTS library, please refer to the *Guide to Sharing and Partitioning IBM Tape Library Dataserver*.

B.21.1.2 Basic Tape Library Support (BTLS)

If you implement the Virtual Tape Server subsystem under BTLS, you can define the tape drives through the Hardware Configuration Definition (HCD) dialogue, or you can use IOCP and MVSCP.

You need to define a new logical library to BTLS that contains all virtual devices associated with this logical library. If only BTLS is using the Virtual Tape Server subsystem, you define all 32 drives.

To direct tape allocations to the Virtual Tape Server, you define a new esoteric unit name and use it in the DD statement for the newly allocated tape data set.

Because of the library definitions, BTLS knows that the device allocated resides in a Virtual Tape Server library.

For BTLS implementation details, please refer to the *Basic Tape Library Support Version 1 Release 1 User's Guide and Reference*.

B.21.2 VM/ESA Environments

After you have defined the new library through HCD, must must define it to DFSMS/VM, if the VM system will directly use the Virtual Tape Server subsystem.

You define the VTS library through the DFSMS/VM DGTVCNTL DATA control file. You define the tape drives that are available though the RMCONFIG DATA configuration file.

To allow the removable media services (RMS) component of DFSMS/VM to perform automatic-insert bulk processing, you must create the RMBnnnnn DATA file in the VMSYS:DFSMS.CONTROL directory. The nnnnn matches up with the five-character library sequence number that is assigned to the Virtual Tape Server during hardware installation.

For details on the implementation of DFSMS/VM and RMS, please refer to the *VM/ESA DFSMS/VM Function Level 221 Removable Media Services User's Guide and Reference*. If the Virtual Tape Server subsystem is shared among your VM system and other systems, additional considerations apply. Please refer to the *Guide to Sharing and Partitioning IBM Tape Library Dataserver* for further information.

B.21.3 VSE/ESA Guests

VSE/ESA must run as a guest system under VM/ESA to use a VTS library. The VSE Guest Server (VGS) support must be installed as well as DFSMS/VM RMS for communication with the Library Manager of the VTS library.

You must define the LIBCONFIG file on the VGS service machine's A-disk. This file simply cross-references the VSE/ESA guest's library names with the names that DFSMS/VM uses.

To enable VSE/ESA guest exploitation of inventory support functions through the LIBSERV-VGS interface, the LIBRCMS part must be installed on the VM system. If VGS is to service inventory requests for multiple VSE/ESA guests, you must edit the LIBRCMS SRVNAMES cross-reference file. This file enables the inventory support server to access Librarian files on the correct VSE guest machine.

For further information, please refer to the *Guide to Sharing and Partitioning IBM Tape Library Dataserver*.

Appendix C. Special Notices

This publication is intended to help customers and IBM technical professionals implement the sharing and partitioning of IBM 3494 and 3495 tape libraries including the IBM Magstar Virtual Tape Server in multiple host system environments. The information in this publication is not intended as the specification of any programming interfaces. See the PUBLICATIONS section for more information about what publications are considered to be product documentation.

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DFSMSrmm
DFSORT
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Enterprise System/4381
Enterprise System/9000
Enterprise System/9370
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Enterprise Systems Architecture/390
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ES/4381
ES/9000
ES/9370
ESA/370
ESA/390
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OS/2
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Appendix D. Related Publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the topics covered in this redbook.

D.1 International Technical Support Organization Publications

For information on ordering these ITSO publications see “How To Get ITSO Redbooks” on page 239.

- *Magstar and IBM 3590 High Performance Tape Subsystem Technical Guide*, SG24-2506
- *Magstar and IBM 3590 High Performance Tape Subsystem: Multiplatform Implementation*, SG24-2594
- *The IBM Magstar Virtual Tape Server and Enhancements to Magstar: New Era in Tape*, SG24-4917
- *DFSMS/MVS Version 1 Release 3.0 Presentation Guide*, GG24-4391

D.2 Redbooks on CD-ROMs

Redbooks are also available on CD-ROMs. **Order a subscription** and receive updates 2-4 times a year at significant savings.

CD-ROM Title	Subscription Number	Collection Kit Number
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RISC System/6000 Redbooks Collection (PostScript)	SBOF-7205	SK2T-8041
Application Development Redbooks Collection	SBOF-7290	SK2T-8037
Personal Systems Redbooks Collection	SBOF-7250	SK2T-8042

D.3 Other Publications

These publications are also relevant as further information sources:

- *IBM 3494 Introduction and Planning Guide*, GA32-0279
- *IBM 3494 Operator's Guide*, GA32-0280
- *IBM 3494 User's Guide: Media Library Device Driver for Application System/400*, GC35-0153
- *IBM 3494 User's Guide: Library Control Device Driver for VSE/ESA*, GC35-0176
- *IBM 3495 Introduction and Planning Guide*, GA32-0234
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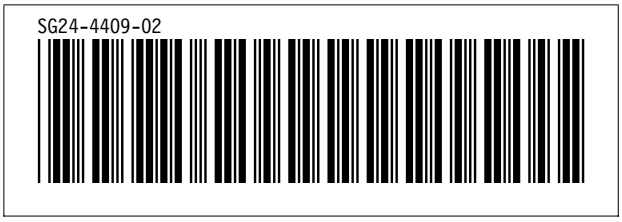
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